NATURAL SCIENCE:

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NOTES AND COMMENTS.

Science and Letters.

THE art of letters has no content of its own and stands in no contrast to science. All of us, in attempting to describe a fossil or to narrate the life-history of a fern, are engaged in the same pursuit as is the man of letters. The distinction, between him and ourselves, too often is this: we are incompetent craftsmen and we are persuaded of the untruth that if you have something to say it does not matter how you say it. Men of letters are not a class by themselves; not mere conjurors with words, amusing the rest of the world with the grace and ingenuity of their antics, by their skilful poise of the adjective and clever balancing of the phrase. They are historians, dramatists, novelists, poets, or, sometimes, parsons and men of science who have conquered not only ideas, but the expression of them. This salutary truth, which should be a truism, may serve as an excuse for reference in these pages to Robert Louis Stevenson, who, since last we wrote, has become but a memory.

In our poor opinion there is much of moment to scientific writers in the art of Stevenson. First, there is the method. Steep yourself in your subject, says the common adviser, then sit down and write quickly. But so doing, your matter will ooze out from you in the flamboyant periods of, say, the late Professor Kitchen Parker, or in the more distasteful prolixity of the average German. Not so does the expression of scientific fact take its appropriate place in the art of letters. The most careful selection and arrangement of the facts are needed, so that the salient points may be thrust into prominence, the subsidiary facts restrained into a decent subordination, and vain

repetition suppressed. If one but consider; an account of the morphology of the tadpole's skull is as difficult to set forth well as the creature of a boy's story. Yet you read "Treasure Island" between London and York after a nice decision between it and the current *Truth*, and Long John Silver sticks in your mind, not to be rid of, a permanent possession. Yesterday you read a description, many pages long, of a new genus, anxious on the details, comparing and weighing: to-day you are running round to the library to read again an important point that failed to impress itself. This happy art of presentment comes not by grace or by knowledge; but by patience and labour.

Next, from the words and phrasing much also may be learned. To those unversed in the analysis of sentences, many lines of Stevenson seem whimsically peculiar, full of deliberate abnormality. But let such examine the easy transition from idea to idea, the orderly progression of the exposition, and they shall see how the words and phrases are chosen and arranged for the simple purpose of presenting the ideas in the directest and shortest fashion, which also is the intention, although not the achievement, of scientific writing.

STEVENSON AND SCIENCE.

FOR the mention of Stevenson a sturdier excuse than our need of the qualities of his style may be found in his excursions into the province of natural science. Of these, two are memorable; the essay "Pulvis et Umbra" in "Across the Plains," and a poem entitled "The Woodman" in the *New Review* for January.

The essay, and we commend it to all readers who do not know their Stevenson, is an attempt with a strongly ethical basis to express a monistic idea of man's relation to the universe, and to contrast with it his kinship to the dust, his thought of duty, and his ineffectual effort to do well. The essay is so short and so well-knit that quotation from it is not advisable. It is however interesting to note that while Professor Huxley in his Romanes lecture (*see* NATURAL SCIENCE, vol. iii., p. 62) laid down that the cosmic process was not only non-moral but immoral, Stevenson reads in it "a bracing gospel."

The poem, published last month, is practically an account of the struggle for existence among plants in the tropics, and much of it might be a paraphrase of Dr. Rodway's essay on the struggle for life in a Guiana forest that appeared in our columns. We quote a few lines:—

> I saw the wood for what it was—
> The lost and the victorious cause;
> The deadly battle pitched in line,
> Saw silent weapons cross and shine;
> Silent defeat, silent assault—
> A battle and a burial vault.

Thick round me, in the teeming mud,
Briar and fern strove to the blood.
The hooked liana in his gin
Noosed his reluctant neighbours in;
There the green murderer throve and spread,
Upon his smothering victims fed,
And wantoned on his climbing coil.
Contending roots fought for the soil
Like frighted demons; with despair
Competing branches pushed for air.
Green conquerors from overhead
Bestrode the bodies of their dead;
The Cæsars of the sylvan field,
Unused to fail, foredoomed to yield;
For in the groins of branches, lo!
The cancers of the orchid grow.

Eozoön: Requiescat in Pace.

The fierce battle which raged between zoologists and petrologists over the nature of that curious structure called *Eozoön* is too well-known to need recapitulation here; but it may be mentioned that Professors King and Rowney, of Queen's College, Galway, in 1865-66, were the first to question its supposed organic origin. Extreme obstinacy, for we may so call it, on both sides prevented an exact examination of the divided collections, and infused into the dispute an acrimony as unpleasant as damaging to all parties concerned. Dr. Moebius was the first zoologist seriously to dispute the organic nature of *Eozoön*, and his book, "Der Bau des Eozoön," appeared in 1878. No satisfactory result was obtained, however, until March, 1891, when, at the instance of Dr. P. Herbert Carpenter, the original Tudor specimen of *Eozoön*, said to be preserved in limestone, and to which the supporters of the organic nature of the structure had pinned their faith, was sent to England by Dr. A. C. Selwyn. At a meeting of the Geological Society in that month, Mr. J. W. Gregory showed that the so-called Tudor specimen of *Eozoön* was nothing more than a series of calcite bands of secondary origin in a rock of Huronian age.

It has fallen to Dr. Johnston Lavis, by reason of his intimate acquaintance with the formation of the Somma-Vesuvian area, and to Dr. J. W. Gregory, intimate with zoological as well as petrological structures, finally to work out and demonstrate, in the most conclusive manner, that the structure known as *Eozoön* is completely paralleled by some structures seen in the ejected blocks of Monte Somma. It is not a little singular that this parallelism has remained unobserved so long, for a specimen of ejected block from this volcano, which has been accepted without hesitation by some of those who have contended for the organic nature of *Eozoön* as true *Eozoön*, has been in the collections of the British Museum more than half a century, and formed part of the series brought by Sir W. J. Hamilton. This

block, of which any quantity can be obtained, is an altered limestone which occurs fragmentarily in the pumice of the series of explosions that excavated the Atrio del Cavallo, known as Phase VI, period 4, and Phase VI, period 1 (Plinian eruptions) of Johnston Lavis. *Eozoön canadense*, therefore, in the view of these authors, is nothing more than the zonal alteration of blocks of limestone which have been enclosed in an igneous magma, a view also supported by its mode of occurrence in Canada and elsewhere. These specimens are fully described and beautifully illustrated by photographic plates in the memoir before us ("Eozoönal Structure of the Ejected Blocks of Monte Somma," *Scientific Transactions of the Royal Dublin Society*, vol. v., series 2, October, 1894), and to this paper we must refer the reader for the details.

Whatever may have been the past history of the dispute, we at present cannot regret it, for it gave rise to a long series of interesting papers, and called forth such an amount of research into organic and inorganic structures as no other object has succeeded in doing. At the same time, it teaches that extreme caution is necessary when dealing with structures difficult of explanation and presenting peculiarities at once characteristic of biological and petrological forms; and while it urges less dogmatism, it shows how necessary it is for the specialist in one branch to call to his aid specialists in other branches, even when examining a structure which appears so obviously to belong to forms with which he is familiar.

Oolite.

The singular resemblances which are seen between organic and inorganic structures were well exemplified at the Geologists' Association at its meeting on January 4. Mr. G. F. Harris read a paper "On the Analysis of Oolitic Structure," during which he showed upon the screen a series of photographs of microscopical preparations of oolitic granules. One of these was a silicious sphere formed in the warm waters of a pool in the Yellowstone district. Commencing as a solid body, the sphere gradually became more and more cavernous, and the outer layers bore a strong resemblance to the organism known as *Parkeria*, from the Cambridge Greensand. These cavernous modifications were probably due to the enveloping of small algæ by the silicious coats. Sections of granules were shown by Mr. Harris from the Great Salt Lake, the extinct Lake Lahontan, the recent oolite sand forming off the Bahamas, and from many localities of the oolitic formation in England. The majority of these granules had characters peculiar to their locality, and the lecturer was satisfied that, so far as the English oolites were concerned, the nature of the grains was sufficiently characteristic to enable him to refer with a considerable degree of certainty specimens of the rock to special localities. The paper dealt only with the structure of the grains, but

the lecturer touched on many interesting points regarding the origin and growth of oolitic granules, full consideration of these latter points, however, being deferred to some future occasion. We shall be much interested to see this paper in print.

The Formation and Absorption of Skeletal Substance in Echinoderms.

In his valuable memoir "On the development of *Echinocyamus pusillus*" (*Nov. Act. Reg. Soc. Sci. Upsala*, ser. iii., 1892), Professor Hjalmar Théel showed that the calcareous spicules were deposited within a protoplasmic mass formed by the fused pseudopodia of several wandering, amœboid cells. The skeletal substance, or stereom, has therefore an intracellular origin. In a short note recently communicated to the Royal Academy of Science at Stockholm (*Öfversigt*, li., p. 345), Professor Théel confirms his former views, and shows that similar amœboid cells have also the power of absorbing the stereom; so that the two groups of cells correspond to the osteoblasts and osteoclasts of the vertebrates. The absorbent cells only differ from the formative cells in the greater activity of their amœboid movements, which give the impression that the process of absorption demands intenser labour on the part of the cell than does that of deposition. When a cell begins to absorb a spicule it strains to extend and flow round and over it, so as to take it whole into its protoplasm; hence the granular main portion of the cell moves incessantly, gliding slowly along the swallowed spicule until nothing remains of it. Meanwhile the pseudopodia are continuously extended and retracted. Since the calcareous particle attacked is often of considerable size as compared with the amœboid cell, we have to suppose either that the latter can dissolve an unexpectedly large quantity of salts and retain them in solution, or that, as is more probable, the dissolved salts are gradually transferred through the pseudopodia to other cells in the neighbourhood, which may either retain them till needed, or use them immediately for building up fresh calcareous structures in the growing Echinoderm. When the calcareous body is too large to be completely enveloped by the absorbent cell a portion of it is detached, apparently by the secretion of an acid, and this portion is then swallowed. A piece of stereom, so large that it can hardly be taken into the protoplasm of the cell, is fully dissolved in about two hours.

This process of absorption not improbably takes place, *pari passu* with the processes of growth, all through the life of an Echinoderm. A familiar instance of absorption is seen in the orals of many crinoids. The process is best observed, however, at the close of the larval period, when the skeleton of the larva is giving place to that of the adult form. In the pluteus or sea-urchin larva, for instance, at this period not only is the larval skeleton in the way, but a large number

of structures requiring calcareous salts are being rapidly developed. The larval stereom, therefore, which has been gradually accumulated from the earliest embryonic stages, may be regarded as reserve material for building up the future complex skeleton of the young sea-urchin. A mere accumulation of such reserve material might conceivably have had a pernicious effect on the larva, but, as things are, the reserve stereom has become essential to the existence of the larva itself, since it has assumed the most suitable form possible for facilitating the flotation of the larva in the sea.

The Duration of Niagara Falls.

In an interesting paper, contributed to the *American Journal of Science* for December, Mr. J. W. Spencer discusses the history and prospects of the Niagara Falls. The paper is illustrated by an excellent set of charts and maps, and should be valuable to the physiographer and geologist. We reprint the conclusions to which he comes:—

"The computation of the age of the Niagara river,—based upon the measured rate of recession during 48 years; upon the changing descent of the river from 200 to 420 feet and back to 320 feet; and upon the variable discharge of water from that of the Erie basin only, during three-fourths of the life of the river, to afterwards that of all the upper lakes,—leads to the conclusion that the Niagara Falls are 31,000 years old and the river of 32,000 years' duration; also that the Huron drainage turned from the Ottawa river into Lake Erie less than 8,000 years ago. Lastly, if the rate of terrestrial deformation continues as it appears to have done, then in about 5,000 years the life of Niagara Falls will cease, by the turning of the waters into the Mississippi. These computations are confirmed by the rate and amount of differential elevation recorded in the deserted beaches. It is further roughly estimated that the lake epoch commenced 50,000 or 60,000 years ago, and there was open water long before the birth of Niagara in even the Ontario basin, and that under no circumstances could there have been any obstruction to the Ontario basin, if even then, later than the end of the Iroquois episode which has been found to have ended 14,000 years ago."

A New Bone-Cave.

In a recent letter to Sir Henry Howorth, Mr. H. C. Mercer, of the University of Pennsylvania, announces the discovery of an interesting bone-cave in that State. It was discovered during blasting operations, in a limestone quarry, and is close to a similar cavern which was opened in 1870, and some of the remains from which were described by Cope. The whole is filled to the roof with a stratified deposit, consisting of fragments of limestone, clay, and sand, in which numerous bones occur. These are all broken, and are said to include remains of mastodon, tapir, sloth, peccary, ox, bear, and, probably, of birds. No remains of man, fishes, or mollusca have yet been met with.

Mr. Mercer is carrying out the excavations with great care, and it is to be hoped that a valuable addition to our knowledge of the cave fauna of North America, at present very imperfect, may result.

The Javanese Skeleton.

Recently there has appeared a quarto of 39 pages with two plates published in Batavia and written by E. Dubois. It is entitled "*Pithecanthropus erectus*, eine Menschenaenliche Uebergangsform aus Java," and, not unnaturally, the title raised hopes that the great gap between the Anthropoid Apes and Man had been bridged over at least partially, and that the long-sought "Missing Link," so dear to popular imagination, had at last been found. One of our correspondents, of some authority in these matters, considers that the facts brought forward appear capable of a different interpretation from that put upon them by the author. The specimens described were obtained from a bed of andesitic ash in the neighbourhood of Trinil, on the river Bengawan in Java, and consist of the upper portion of a skull, a molar tooth, and a left femur, which are regarded as having belonged to a single individual. The femur was found some fifteen metres from the other remains, so that its association with them, though highly probable, is not certain. This bone is certainly human, for it agrees in all important respects with the femur of a man of average height. The most significant point about it is that it is diseased, a considerable irregular growth of bone having taken place on the inner side, a short distance below the head. The skull, of which only the upper and hinder portion is preserved, is described as dolichocephalic, and as being distinguished from the skull of the Anthropoid Apes by its larger size and more arched forehead. Its length is 18·5 cm., and the capacity of the brain case is calculated to have been 1,000 cubic cm., but the data for this latter measurement are insufficient owing to the complete absence of the whole of the lower portion. If, however, we suppose the cranium to have had approximately the cubic contents given, it would be in this respect about two-thirds the size of an average human cranium and about twice that of the skull of a middle-sized gorilla. The sutures are all closed and there are no crests for the insertion of muscles. Examination of the photographs of this specimen shows that the whole surface of the bone is rough, being covered with irregular pits, a condition indicating that, like the femur, it was diseased. It seems, therefore, most probable that the skull owes its peculiar form to the premature closing of the sutures, and that it belonged to a microcephalic human being. It may be remembered that the Neanderthal skull, to which great importance was attached at the time of its discovery, has been held by Meyer and Virchow to be pathological. Although Java is, perhaps, a not unlikely place to find the remains of an immediate ancestor of man, that discovery is yet to be made.

A Little Knowledge.

It is cheering to note the elevation of the masses by the spread of education. Even your journalist begins to have some glimmerings of a world beyond his own, and, like a child in the arms of his bathing-woman, splashes ineffectually in a sea of unfamiliar words. Monarchs and premiers are laid on the shelf, China and Japan bicker in obscurity, while he, the purveyor of novelties, rushes after that inspired creation of our prince of journalists—"the Pliocene Plesiosaurus." But, of a surety, all these penny-a-liners must now confess themselves conquered by Autolycus. These are some of the delicious sentences in which the erudite trifler of the *Pall Mall Gazette* introduces an article on the chair:—"Primitive man discovered the chair; not, of course, the chair as we know it, but the embryonic, nucleated chair. With the eye of sympathetic imagination we can see that poor untutored, unenfranchised ancestor of ours at work upon the task of discovering the chair. It is the evening of a day millions of years back; the deep primæval forest resounds with the bellowings of the mastodon, the howls of the plesiosaurus, the squeakings of the ornithorhynchus, and the gibberings of other creatures with names as terrifying as themselves; and the sun is going down in the west. Our ancestor has been chopping wood and swearing at that blunt stone adze of his." This is charming—but a little inartistic, is it not? to make the sun set in the west. There is a want of imagination about that statement, little in harmony with nucleated chairs and forest-loving plesiosauri. Seriously to consider it, this is as though Reuter were to inform us that the Queen of Sheba spent a karyokinetic afternoon riding down Broadway on a mammoth, and finished up at Delmonico's with a supper of fried trilobites. The truth and the humour of it are on a level.

It is to be feared that Autolycus derives his knowledge of prehistoric man, as many self-constituted critics make their sole acquaintance with Ibsen, from the pages of *Punch*. But we are sure that Mr. E. T. Reed does not, any more than Mr. Anstey, desire his humorous sketches to be regarded as even an approximation to the truth. Nevertheless, Mr. Reed will pardon us if we suggest that his earlier imaginings, such as "A Naval Battle" and "A Slight Difference with the Local Mammoth," were more truly humorous than those later ones in which impossibly post-dated caricatures "run riot o'er the land." There is a sesquipedalian humour about some of these monsters that is by no means convincing. It really is not right of this ingenious artist to confuse the minds of his public and his fellow-journalists, and above all to lay such traps for poor Autolycus.

But perhaps this is hypercriticism. What are a few million years more or less? "Aliquando bonus dormitat" even Lord Kelvin. And surely a slight mixture of periods is not to be imputed for a fault to those who, like Autolycus and Shakespeare, write "not for an age, but for all time."

A Progressive Learned Society.

The Royal Geographical Society has been planning certain measures of reform, some of them of considerable interest. Thus the Society has not only reconstructed its premises so as to afford greater facilities of reference in its Library: it has added a new Reading-room, and endeavoured to better the accommodation of its Fellows generally. They may use the Council-room for the purposes of reading or of writing letters, and in another room they have the privilege of conversation and tobacco. These efforts to give the Society some of the advantages of a club are most praiseworthy, not only from a social but from a scientific point of view; and they might well be followed by other learned societies. As a rule the privileges of Fellows of these Societies are practically confined to the consultation and borrowing of books, and to the attendance at evening meetings. Little or no social intercourse is possible owing to the want of a conversation-room; nor is any adequate provision made for the writing of letters, &c.

The Royal Geographical Society, it is true, performs some functions that other societies might find it difficult to adopt; its map-room, thanks to Government aid, is open to the public, so that anyone may go in and learn what is known about the geography of any portion of the world. Nevertheless the Society labours in other ways which serve to promote the study of geography, and which might be followed by some of the older but less energetic societies. It organises lectures both technical and popular, and aids travellers and explorers in a variety of ways. Perhaps the most important of its departures is its federation, at present informal, with other societies in Liverpool, Manchester, Newcastle, Edinburgh, and other large towns. This alone is a subject most deserving of the attention of scientific societies, for by such means, in due time, the great and accumulating burden of literature might, to a certain extent, be concentrated and generally lightened—to the great benefit of those now living, and to the greater benefit of those who come afterwards.

"The Zoological Record" in Parts.

We desire to direct the attention of such of our readers as may be engaged on original zoological research to the letter from Mr. S. Pace that we print in this number. The general complaint as to the present system of selling the *Zoological Record* in one bulky and expensive volume, to those who really need only a few pages maybe of it, was admirably voiced in our own pages not long ago by the Rev. T. R. R. Stebbing in his vivacious article, "On Random Publishing and Rules of Priority" (vol. v., p. 341).

No one has ever been able to understand why the authorities at the Zoological Society persistently refuse the persistent demand for the sale of the *Record* in separate parts. A few despairing students

have at last put on Pace to break the *Record*, and we trust that their effort will meet with the success it deserves, especially as it cannot possibly injure the finances of this ponderously respectable publication. The fatuity of the present enforced alliance of diverse groups is obvious to any dipper into the volume; for the diversity of treatment meted out by the recorders to their respective groups is no less than that of the groups themselves.

In this connection we may state that, as at present understood, the Central Zoological Bureau, projected by Dr. Field and others, intends to issue its slips and its Record in parts, according to the various subjects. This alone would be enough to give it an advantage over the present *Zoological Record*. In reply to many enquiries, we take this opportunity of stating that Dr. Field may be addressed at No. 67, Rue de Buffon, Paris, but that, during February, he will be in England, intent on advancing his project.

Warning Colours.

Professor Felix Plateau, who is so well-known by his work upon the sense of sight in insects, has lately published an interesting paper upon the "Magpie moth." This insect has often been quoted as an example of "Warning colour" in all three stages of its existence. The white, yellow, and black of the caterpillar are repeated in the moth, while the pupa is brown, banded with yellow. Professor Plateau carried out his studies in so thorough a fashion that he not only caused other animals to eat the caterpillars, but ate them himself, "after some natural hesitation." The flavour, instead of being disagreeable, proved to be the reverse, reminding him a little of almonds. No less than 43 per cent. of the caterpillars are devoured by ichneumon flies, while spiders, beetles, a few birds, and, according to the experiments of Mr. Beddard, quoted by Professor Plateau, certain monkeys and other animals will eat them with pleasure. It is difficult therefore to see exactly where the advantage of the warning colour comes in. So small a percentage could be saved by this means. Professor Plateau's conclusions are very much the same as those arrived at by Mr. Beddard in an article upon the "Magpie caterpillar" in the *Gentleman's Magazine* for 1890, but they are based upon a larger series of experiments. It would be as well if all the examples of warning coloration were subjected to asc areful an examination. Professor Plateau's paper is to be found in the most recently issued part of the *Mémoires de la Societe Zoologique de France*.

Mimicry.

Professor Plateau, however, is not entirely against current theories of the kind. But he appears to think, and rightly, that they have been a little too much used as an universal explanation. In a paper in *Le Naturaliste* figures are given of the "Merveil du Jour" and of

the "Scarse merveil du jour," two moths which have mottled green fore-wings, and which in a woodcut look very much alike. They are not, however, quite so much alike when seen alive; but the resemblance is just as good as that shown in many cases that are put down to "Mimicry." In this case, however, there can be no possible question of advantageous mimicry, for the two insects appear at different times of the year. The scarcer insect delights the collector in the New Forest in June, while the common "*Aprilina*" is abundant everywhere in early autumn. The advocates of Mimicry have shown a regrettable tendency to ignore examples of this kind, which are by no means rare.

"Letusimulation."

We are no unfriends of neology, holding that, when a new idea has to be presented, or an old idea divided, it frequently conduces to clearness and accuracy to coin a new word rather than to stamp a new meaning on an old word. A writer in a recent issue of the *American Naturalist* gives some pleasant notes on the well-known habit possessed by many animals: the feigning of death when they are touched. So far so good. He chooses to call this habit "Letusimulation," and tells us that the word is derived from *letum* death and *simulare* to feign. Could anything be more ridiculous? *Letum* really is not a Latin word at all, but is an obvious loan from the Greek, occurring in a few late authors. But even were it a Latin word, the English derivative would be letisimulation. Even were the form correct, what object in this world of trouble is to be gained by inventing a barbarous polysyllable for an idea that has its perfectly simple English form, and that under no possible circumstances could be confused with any other idea? The inventor has already taken a further step in the propagation of his nonsensical jargon; for he tells us that he has contributed to the *Atlantic Monthly* a paper on "Animal Letusimulants," meaning, of course, "feigners of death." If the editor of the *Atlantic Monthly* cannot project off his own bat such a title into the waste-paper basket, he should ask advice from some intelligent man of science before he accepts a new phraseology as ugly as it is futile.

An American Snake-eating Snake.

Mr. Angus Gaines, in a recent number of the *American Naturalist* (1894, p. 970), gives an account of the exploits of a specimen of *Ophibolus getulus*, captured and kept in captivity. This small snake rivalled a recent feat at the Zoological Gardens.

Mr. Angus Gaines writes:—"After he [the *Ophibolus*] had been in my possession for 25 days, I captured a *Eutænia radix*, which I put in the same enclosure. The other snakes paid no attention to the newcomer, but the *Ophibolus* roused at once, as if scenting a natural enemy, and seized the *Eutænia*. The fight was long and fierce, for the *Eutænia* was strong and active, and was five inches longer than

his assailant, but the *Ophibolus* gained the victory and undertook the seemingly impossible feat of swallowing his victim. This task occupied the whole night, but he actually succeeded in swallowing the snake five inches longer than himself. This very hearty meal distorted him beyond recognition, and he gave no signs of life except by a slight twitching of the tail. After an absence of some 40 hours I revisited my terrarium, and found that he had disgorged his prey and resumed his proper shape.

"Since that time the *Ophibolus* has taken no food, though he is still strong and active; his spots, however, which were originally of ivory whiteness, have assumed a sulphur yellow hue.

"I tried placing a looking-glass in my terrarium, and the *Ophibolus* showed signs of excitement at the first sight of his reflection, but afterwards paid no attention to it.

"My *Ophibolus getulus*, 12½ inches long, after going fifty days without food, except the one snake which it subsequently disgorged, killed and ate a *Natrix sipedon* over eight inches long, and is doing well."

A New Plant.

New forms of life are always interesting; but they are specially interesting when they belong to the strange debatable land that lies between the lower confines of the animal and vegetable kingdoms. The recent issue of the *Annals of Botany* (vol. viii., no. 32) opens with an account of a new alga-like organism given by Mr. B. M. Davis, who found it in the salt marshes of the Charles River, Cambridge, Massachusetts, where it covered the stems of marsh-grass and other objects so thickly as to give their surface the appearance of a dark green velvet. The organism is a very lowly one, and its exact position is dubious. Mr. Davis, however, after a careful description of its structure and life-history, gives reasons for placing it on the plant side of the border, its nearest relations being some genera of the family Tetrasporeæ. *Euglenopsis*, as the author names his new genus, from certain resemblances to *Euglena*, shows an extremely peculiar structure and mode of growth. It consists of branching filaments composed of empty cell-cavities or compartments, the ends of the branches bearing green cells. The larger specimens reach about a fourth of a millimetre in height. The terminal green cells contain protoplasm, in which we can distinguish a nucleus, two spaces containing cell-sap, and a green band or chromatophore, in which is a bright red pigment-spot. The protoplasm may escape from the cell-wall and become a motile organism comparable with the large zoospores of many algæ. Each zoospore is provided with four motile filaments or cilia at the lower end, by means of which it swims. The change from a stationary to a motile condition occurs during the night. When specimens were kept in an aquarium, swarms of zoospores collected, each morning, on the sides of the glass towards the light, which, therefore, exerts a directive influence similar to that observed in the case of other algal zoospores. After a time a resting

condition is resumed, the organism protecting itself by a new cell-wall.

The branched filament characteristic of the adult is the result of a unique method of growth. The cell has assumed the resting condition, and its protoplasm contracts, leaving the lower end of the cell but remaining attached above. This then is drawn entirely into the upper half of the cell and the empty half becomes shut off by a transverse wall. Similarly a second and a third empty compartment may be shut off immediately above the first. Numerous repetitions of this process occur, and the adult plant is characterised by being composed of a series of empty compartments ending in a true cell. Branching results from a longitudinal but oblique division of the protoplasm into two cells, each of which grows in length, the upper continuing its straight course, the lower being pushed out laterally and thus forming a branch which repeats the mode of growth of the main stem filament.

The Growth of Wounded Roots.

In a recent number of Natural Science (vol. vi., p. 9) we referred to some experiments by which Dr. Pfeffer had shown the root-tip to be the seat of sensitiveness to the stimulus of gravity. In the issue of the *Annals of Botany*, mentioned in the foregoing note, our readers will find an account of some work on the same lines by an American botanist, Professor V. M. Spalding, carried out in Pfeffer's laboratory at Leipzig. The subject is the investigation of the curvatures, styled traumatropic, which follow the infliction of wounds on the tip of growing roots. These phenomena were first studied by Charles and Francis Darwin and described in the "Power of Movement in Plants." Young seedlings were allowed to grow in moist air, and a small piece of card was fixed on one side of the tip of the short rootlet by means of shellac dissolved in alcohol. A large proportion of these rootlets became considerably bent, curving away from the side to which the object was attached. A similar result followed when nitrate of silver was used as an irritant, or when thin slices were cut off parallel to one of the sloping sides of the apex.

In their explanation of these experiments the authors concluded that sensitiveness resided in the tip of the root, a theory which Pfeffer's recent ingenious experiments have put beyond doubt; and also that extremely slight pressure or simple contact was a sufficient irritant to induce deflection. Detlefsen repeated the Darwins' experiments, and came to the conclusion that the curvatures were simply a mechanical result of an injury to the root-cap. When this is injured the tissues beneath are partly released from strain, and extend more rapidly than those on the opposite side, thus causing convexity of the side affected. Professor Spalding, however, observed that curvatures in the radicle of a bean follow a branding of the tip after the removal

of the root-cap. He also finds, as Wiesner proved ten years ago, that the curvatures do not result from simple contact, and from several experiments adduces strong evidence that they are the result of an injury to the growing point. Thus they follow a small injury which extends to the growing point but fails to take place even after extensive injury in which the growing point is not involved. Some of the most interesting cases cited are those which show that the stimulus to a curvature may remain latent during an artificial suspension of growth. It was found that roots which have been wounded may have their growth in length stopped by confinement in plaster casts for several days, and that traumatropic curvature still takes place when they are released and growth is resumed.

Finally, the author claims that the experimental evidence adduced justifies the belief that the growing point of the root is sensitive, and that its irritation induces the curvature in the zone of rapid growth behind the root-tip. Such results are comparable with those obtained in the study of curvatures induced by the stimulus of light and gravity. For instance, in the case of the cotyledons of grasses the tip has been shown to be most sensitive to the directive action of light, the stimulus being transmitted from the tip to the lower part, where, after an interval of time, the corresponding curvature is observed.

SIR HENRY HOWORTH'S COMPLAINT.

In a letter, printed in our last issue (NATURAL SCIENCE, vol. vi., p. 71), Sir Henry Howorth complained that two specialists, who are both distinguished men and both officers of the same museum, have within a year of one another published two volumes on reptiles in which the same forms have "not merely different names but are put in different genera." We find that Sir Henry Howorth is quite right in his facts. Indeed, we are assured by those who know that some sixty per cent. of the species are called by different names in the two works. Certainly it is a matter for regret that divergence of opinion so extreme should exist between two high authorities from whom the public may expect guidance; and the public will be still more puzzled to find that in the case of the British Museum Catalogue the same authorities are in amiable conjunction, the one as author the other as editor. But it may be pointed out that the fact of both being officers of the same museum has nothing to do with the case. In the official Catalogue the two agree; but the trammels of office must not hinder free expression of opinion on scientific matters, even on specimens contained in the museum, when that expression is made in an unofficial and purely private publication, such as the *Biologia Centrali-Americana*.

On the general question of divergent nomenclature we think that Sir Henry Howorth's complaint is exaggerated. The whole

tendency of modern nomenclature is to render it less and less dependent "on the personal equation of the particular writer." Existing confusion has arisen from two distinct causes. First, in old times different names were given by writers to the same species, because they ignored or were ignorant of each other's work; the name given by the most arrogant writer was as a rule the one that usurped the field, at all events until the law of priority was put in force. Second, ignorance either of facts previously published, or of facts as yet undiscovered, caused the reference of many species to the wrong genera. To retain for such species the names by which they were described originally, as Dr. D. Sharp once suggested, would be to render names of no meaning, to turn them into mere numbers in a catalogue, and to abrogate the Linnæan system.

These two facts account sufficiently for the existence of different names for the same animals. To complain of the regrettable fact that two persons should take different views of the same question is merely to cry out against human nature. Personally, we are on the side of the more modern view. We think that the law of priority, dating from an accepted standard like the tenth edition of Linnæus's "Systema Naturæ," must determine the specific name, and that the reference of species to genera must depend upon the completest and surest anatomical information, however much such may disguise familiar animals under unfamiliar names. But in these matters there is room for "personal equation"; in the matter of anatomy always; in the matter of the first specific name, when the type-specimen is unknown or the description vague. It is little wonder that there may be capable zoologists of conservative habit who prefer the names that they consider to be stamped by long usage to names that they might admit to be more philosophical. That differences of the kind mentioned by Sir Henry Howorth should occur in two publications, the one a private production, the other the catalogue of a museum, we take to be unavoidable and natural. On the other hand, were such divergence to occur in the nomenclature adopted in a single volume or in a single museum, unhesitatingly we should assert it to be a fault of the gravest nature.

His Own Petard.

The *Journal of Botany* has taken on itself to criticise a few fairly obvious misprints that lately crept into the *Geographical Journal*. In his eager anxiety to throw stones, the editor has omitted to test the walls of his own house. In three lines of the very paragraph in which he insists on the wickedness of spelling botanical names incorrectly, "*Hemichrysum*" is first misquoted as "*Hemichysum*," then blunderingly corrected to "*Helichysum*," when all the world knows that it should be "*Helichrysum*." By this time the editor of the *Journal of Botany* has probably learned that the wiles of the printer are not to be combated by the "Assistant-Secretary of the Royal Geographical Society,

under the authority of the Council," any better than by his own learned self.

But if the editor of our esteemed contemporary is sincere in his wish to reform the orthography of scientific periodicals, he will not be offended if we suggest that he might supervise with greater care and consistency the spelling of geographical names in his own journal. In a single paper in his last volume, Lake Naivasha is spelt in one place "Nawasha," in another "Navaisha"; "Durama" we may guess to stand for Duruma, and "Nakuru" for Nakuro, while "Inhuyuni" may mean Mkuyuni—but if so, as it is said to be "inter Nawasha [*sic*] et convallem Baringo," its position has been altered even more than its spelling; finally the poor botanist who searches in the Ulu Mts. for a second specimen of the species recorded from the "Ulau" Mts., is not unlikely to be disappointed and to have to tramp off to the very different and distant range of Mau. With these little eccentricities all in one paper, it is hardly worth quoting from the rest of the volume; and doubtless it is only as a practical illustration of the advantages of "home rule" that the editor allows his contributors to spell the name of an important botanical district either "Cameroons" or "Camaroons" as each may prefer.

Mollusca as Purifiers of Water.

The following interesting note appears above the signature of Charles Hedley in the *Journal of Malacology* for December 12th :—

"A use, novel to me, of pond snails by the Chinese silk growers is described in an official work which caught my eye by chance. This waif of malacological information is so certain to escape recorders that I transcribe the passage.

"'Report on Silk. Imperial Maritime Customs of China, ii., Special Series, No. 3; *Shanghai*, 1881, p. 57.

"'The water used for reeling silk is taken from mountain streams, as being the cleanest; the water from wells is never used; and if mountain water cannot be had, river water is taken, which is cleaned by putting a pint of live shellfish to one jar of water. There is a special kind of shellfish, called the pure water shellfish [here follows the vernacular name in Chinese characters] (fig. xxiv.), found everywhere in ponds, wells, and creeks. They first of all sink to the bottom of the jar, and then by degrees make their way up its sides, consuming gradually all impurities in the water within half a day or so. After the clean water has been drawn from the jar, the shellfish are cleansed and put to the same duty again.'

"As the three coloured figures are drawn in Chinese perspective the species cannot be certainly identified. They are, however, sufficiently like Reeve's figure (Conch. Icon., vol. xiv., *Paludina*, pl. iv., f. 18) of *Vivipara chinensis*, Gray, to assume that this the artist endeavoured to portray."

I.

The Mammals of the Malay Peninsula.

Part II.

CARNIVORA:—Probably there is no part of the world which for its size contains so many animals of this order as the Malay Peninsula. Very little is known of the habits of most in the wild state, since almost all are nocturnal and most live concealed all day in the masses of creepers at the tops of the bigger trees.

The tiger or "Rimau" (*Felis tigris*) is still over-plentiful in Singapore, and few of the larger forests are without one or more for long; but so dense is the undergrowth, and so quiet is the animal, that it is rarely seen and very seldom shot. It inhabits the more open country and small patches of forest. In the dense hill-forests of the interior it is not usually found, and is replaced by the black panther. The animals are seldom very large, and are light coloured. They habitually swim over to Singapore, across the Johore Strait, usually by way of the intermediate islands of Pulau Ubin and Pulau Tekong. They make the passage at night, landing in the early morning. As so much of the coast is mangrove swamp, and the animals do not risk going through the mud, they are only able to cross where the shores are sandy, and thus they have regular starting and landing places. They often come over to Singapore for breeding, and the slopes of the wooded hill Bukit Timah and the sandy woods of Changi, near one of their favourite landing places, are the usual localities selected. The young are brought forth in December or January as a rule, and parents and young remain together in the same locality till about Easter, when, as by this time the food in the locality is exhausted, the family scatters, and either wanders over Singapore, or, if the young are old enough, swims back to Johore.

During the day the tiger remains sleeping in the shady parts of the jungle, unless the weather is wet and windy, when it becomes restless and wanders about. About four or five o'clock it rouses itself and begins to roam about in search of prey, continuing its walk till about eight o'clock in the morning, when it again retires to sleep. When very hungry it will seek food in the daytime, and has been known to attack bullock carts in broad daylight in Malacca. It lives for the most part on pigs, wild and tame, deer, dogs, fowls, and

mousedeer, but it has also been seen in the mud of a mangrove swamp digging up and devouring shell-fish.

When hungry the tigers are very bold; thus, on one occasion, a tiger invaded the house of a European near Singapore in the night and stole a joint of beef which was in the kitchen. One night a tiger entered the open door of a Chinese hut on the edge of the jungle in Pulau Ubin, and walking through the ashes of the fire (where I saw its footmarks), broke through the lattice-work wall of the house and went away, to the relief of the Chinaman. The following night four tigers walked up the steps of another house close by, apparently in search of the owner or his dog; by breaking through the back of the house the inhabitants managed to escape, leaving the house to the tigers.

The tigers are usually quite harmless to human beings, but now and again take them. Wallace mentions that in his time a man a day was killed in Singapore. This is easily credible, the forests were then being cut down, and many Chinese were employed in this work, and being scattered over the jungle, were doubtless easily taken. In Singapore of late, till the last two years, the average was one native every two months. The number of deaths from tigers given by Wallace and Jagor has been ridiculed as improbable by some writers, who appear to have derived their information from the Police Reports, ignorant of the fact that many such deaths do not get reported to the police for the following reason. The chief people killed are the Chinese gambir- and pepper-coolies. Now, on a Chinese plantation, coolies are not allowed to talk of tigers, for fear of frightening each other. Even if a tiger is seen, a coolie is not allowed to mention it, and, if a man is killed, he is buried quietly and a false return of death given if possible. This is done to prevent the coolies from being frightened and leaving the plantation.

The two popular fallacies still to be found in some Natural History books, that a tiger when once he has attacked and eaten man becomes a man-eater and that it is only very aged and toothless tigers which devour men, have elsewhere been shown to be false. Sometimes one or a couple of tigers will take to man-eating regularly, but this is not common here, and has never happened as far as I know in Singapore, while those which have done so and have afterwards been shot have usually been found to be fine young beasts. The Malays often talk of the "Rimau Kramat," a sacred tiger, which is stated to be a very old hairless and toothless tiger, perfectly harmless and quiet. I have been shown footprints of very large animals said to be "Rimau Kramat."

As has been said, it is usually Chinese coolies who are taken by tigers. Working early and late in the gambir-fields, their bare brown skins are sometimes mistaken by the tiger for those of the deer which often come in the dusk or at dawn to browse on the gambir shoots. Rushing on the unsuspecting coolie from the long grass

or scrub where he has been lying in ambush, the tiger strikes him dead with one blow of the paw on the shoulder. Sometimes the body is left untouched, often it is dragged to the jungle and partially devoured, the thighs and throat being first eaten. It appears to be rather an exception here for a tiger to return to the kill.

Sometimes a man is watched by a tiger apparently for some days before the latter can make up his mind to take him, and at times is stalked from a considerable distance. The following is an instance of a fairly common kind of occurrence which took place in Singapore in 1890. Two Chinese coolies were returning from a gambir-field at six p.m.; one, delaying for an instant, did not overtake his companion, who presently missing him, called out, but got no answer, and so went on to the house. After a short time, being alarmed, he, with his companions, returned to the spot with lights—for it was by this time dark—and finding a pool of blood, all ran back to the house. Next morning the body of the man was found in the jungle, lying on the face, with the thighs eaten. The tiger must have been stalking the men from the patch of jungle, and must have crept up to them through the gambir-bushes for fully five hundred yards, and then struck the coolie dead noiselessly by the side of his companion. The body was removed to the house, and I was informed that the tiger visited the house the next night and took a fowl away, and continued to come each evening till the body was taken to town for burial. Though the tiger remained for at least some weeks in the same jungle, it never attacked any more of the coolies.

The Malays have many superstitions and stories about tigers. Certain people are supposed to have the power of turning into tigers for a short time, and resuming their human form at pleasure. The transformation commences tail first, and the human tiger is so completely changed that not only has it all the appearance and actions of the tiger, but on resuming its human form it is quite unconscious of what it has been doing in the tiger state. A much dreaded form of demon is that of a headless tiger which is supposed to be seen rambling about at night.

The black panther (*Felis pardus* var.) is called "Rimau Akar" (*lit.* tiger of the Lianas) by the Malays, probably because it lives in the masses of creepers in the big trees, though I have no evidence of its being arboreal. It is said to have occurred in Singapore, but this appears doubtful. It is abundant in Johore, and formerly occurred in Pulau Ubin between Singapore and Johore. It appears to go further into the hill-woods of the interior than the tiger. Very little seems to be known of its habits. It is quite harmless to man unless wounded, and lives chiefly on goats, fowls, and dogs. In captivity it is always very ferocious, and never appears to be at all tamable. The spotted form is at any rate rare in the south of the Peninsula if it occurs at all, but it appears to be fairly common in Perak and the northern part of the Peninsula. The more slender form, commonly

called the leopard in opposition to the short thick panther, is said to occur in the Peninsula. The relations of these forms or subspecies in the Malayan region are well worth the study of local naturalists.

The smaller cats are very numerous in the Peninsula, but owing to their nocturnal habits very little is known of them in the wild state. They appear to live all day in holes in trees or high up among the creepers, coming out at dusk in search of prey. In captivity they usually remain motionless all day. A *Felis planiceps* which I have in captivity, remains in one corner of its cage, without moving, till night, when it comes out to take its food. The commonest wild cat is *F. bengalensis*. I have seen it in Singapore, and it appears to be abundant in the Peninsula and to be often trapped. *F. tristis* has been taken in Malacca; and I had a fine golden cat, *F. temminckii*, from Pahang. The latter was very quiet in captivity, but was never at all tame. When taken young *F. bengalensis* becomes very tame and playful, and lives a long time in captivity, but trapped adults are always ferocious and ill-tempered. The native name for a cat is Kuching; wild ones are called Kuching Hutan (wood-cats) and the large ones Kuching Rimau (tiger-cats).

The Viverridæ are well represented here. The commonest species is *Viverra malaccensis*, the Musang. It inhabits hollow trees or masses of creepers, or very commonly takes up its abode in the roof of a house, leaving its hiding place in the dusk and rambling about in search of food. It is very regular in its habits. I have had no less than seven living in the roof of the house at one time. The animals used to leave the house about six p.m., descending by one of the posts of the house, and would return at nine o'clock, leaving again later in the night, and coming back at about five a.m. Once I saw Musangs moving about in the top of a tree at midday; they were an old one and one or more young, which the adult was apparently teaching to walk on the boughs. Musangs are very clever at climbing, far more so than a cat. A pet one, belonging to one of the officers, used to walk skilfully on a very thin string; put on the tightened twine, it would grasp it with its fore-paws and draw itself up, and then balance itself by waving its tail round and round, or even by clasping the string with its tail, which is slightly prehensile; when it had got its balance it would walk along the string briskly, carrying the tail free. The Musang feeds chiefly on fruit, but also devours birds, and is a great nuisance to pigeon- and chicken-fanciers. It is very serviceable, however, in keeping away rats from a house.

It plays an important part in the dispersal of seeds, eating a great deal of fruit, and dropping the seeds on paths and bare places on the ground, where they speedily spring up. It seems particularly partial to the fruit of *Strychnos tieute*, in which the seeds are enclosed in a very bitter pulp, apparently rich in brucine. It is most troublesome to fruit growers, and especially in the coffee-fields, where it devours the coffee-berries and passes the seeds uninjured. As it

always selects the best berries, the seed passed by it is usually considered the best for planting, and indeed has fetched a high price in the coffee-markets. Musangs are usually easily trapped, but after a few have been caught the rest become wary. The common form of trap is a hemicylinder of sticks about 3 feet long and about 8 inches across. This is propped up with small sticks after the manner of a figure-of-four trap, and some heavy stones put upon it. A plantain is put inside as bait, and the civet on entering the trap to eat it touches the supporting sticks which let fall the cage; and the stones prevent the civet from lifting it up again. Other modifications of this trap are also used. The civet cat is very easily tamed, especially when caught young, and makes a clever and intelligent pet.

The larger civets, *V. zibetha* and *V. tangalunga*, the "Musang Jebat," do not, I believe, occur wild in Singapore, but are common in the Peninsula, and are often trapped and brought for sale. They are never at all docile, and seldom live long in captivity.

The Water-mungoose (*Herpestes brachyurus*) is very rare in the Peninsula. A living example was presented to the Gardens by Dr. Johnston, who obtained it in Tringganu. The natives called it "Musang Babi," Pig-civet, because it bristled up its hair when excited and resembled somewhat a very small wild pig. It lives exclusively on fish, refusing meat, and is very fond of bathing. I know nothing more of its habits, and few natives have ever seen it.

The Bear-cat (*Arctictis binturong*), the "Bintūrong" or "Menūrong" of the Malays, is generally obtained in Malacca, and is sometimes kept as a pet. It is easily domesticated, and becomes very affectionate, and will follow its master like a dog. It feeds on fruit, also taking small birds, and is of arboreal habits, climbing about well and aiding itself by its prehensile tail, which it uses chiefly to lower itself from branch to branch. When suspicious it growls fiercely, ending up with a kind of barking spit; when pleased it makes a humming noise. It appears very nervous of snakes, turning its face away and protecting it with its fore-paws, whence I presume it is not a snake-eater. From its enemies it defends itself by trotting quickly forward and biting viciously. When very happy it jumps about with all four feet off the ground in a very comical manner.

The Common Bear (*Helarctos malayanus*), "Bruang" of the Malays, is so well known that it is hardly necessary to say anything about it. It is tolerably common in the Peninsula, but is absent from Singapore. Formerly, rewards were offered for its destruction, but it appears to be quite harmless to man unless wounded, when it becomes dangerous. It is, however, a troublesome enemy to fruit growers near the jungle in which it lives, being very partial to durians. A tame one, when it got loose, would often climb up a tree, and breaking off the branches, make a kind of nest in which it would sit for a few minutes; but I believe that in a wild state it lives, at least usually, in holes dug in the ground, or among ferns and bushes. It is exceedingly

powerful for its size, and the Malays say that if it can get its back against a tree it is a match for the tiger.

Two species of otter have been met with in Singapore, viz., *Lutra sumatrana* and *L. leptonyx*; but they seem to be rare, and little is known about them. The Malays often call them "Anjing Ayer" (water-dogs).

Very little is known about the wild dogs of the Peninsula. The natives say that there are two species, one larger than the other, and that the smaller one climbs trees. One species seems certainly to be *Cyon rutilans*. I have had three wild dogs in confinement, one of which seemed to be decidedly a larger-built animal than the two received later. It became tame enough to touch. The cry was a yapping followed by a howl. It was very active, running up the side-walls of its cage to a height of about 12 feet. It never wagged its tail, but in the presence of other dogs arched it gracefully. These animals are said to hunt in packs, but are very rarely seen. I once found the tracks of a single one following those of a deer. The native name for them is "Anjing Hutan" (wood-dogs).

Rodentia:—These are tolerably numerous; but the smaller ones, rats and mice, are not at all easy to collect or study. I have attempted to trap them in the jungles, but, when caught, wild cats or civets constantly devour them in the traps ere morning, and the Malays are not clever, like the Dyaks, in catching them.

The Common Porcupine, "Landak" (*Hystrix leucura*), is still common in Singapore, but a number must be destroyed by the burning of the open country, in which they chiefly live. They are very destructive to the pineapples. The tiger kills and eats them, and I have found the remains of one so destroyed. The brush-tailed Porcupine (*Atherura macrura*) is not a native of Singapore, so far as is known; it inhabits the limestone caves in Pahang.

Squirrels are very common and easily observed, but the number of species is not very great. Two species, *Sciurus tenuis* and *S. vittatus*, are very abundant in woods and gardens. *S. bicolor* is rarer, and inhabits the thicker jungles. I have seen several other species in Singapore which I was unable to secure. *S. tenuis* is a very small and active squirrel, very abundant and destructive in the Botanic Gardens. It feeds chiefly on acorns and chestnuts, and plays an important part in the dispersal of seed. When it gathers an acorn or a bunch of chestnuts, it runs off to some distance to eat it, holding it in its mouth. Hanging head downwards on the bark of a tree, it begins to nibble the acorn, which frequently slips from its paws and rolls away unhurt. Some of the acorns seem adapted for this slipping, being covered with a thin, smooth, silky coat; in other cases, the fruit is so smooth and rounded that the squirrel can only bite it at the base, and they frequently begin to bite the acorn cup to get at this part, with the result that the acorn slips suddenly out and falls to the ground. Fuller notes as to the action of squirrels on the

dispersal of seed will be found in a paper on the Dispersal of Seeds by Mammals in the *Journal of the Straits Asiatic Society*. This squirrel utters a sharp, bird-like, twittering cry when playing about or when alarmed, and also a double-noted cry, "Atcheh, Atcheh," when pairing. I have seen a pair of squirrels fighting briskly; they gripped hold of each other and fell in a ball from the upper boughs of a tree, but before reaching the ground separated and clung to the lower boughs, rushed up to the top, closed again, and again fell, till at last one fell on the ground and rushed off, pursued by the other. The nest is often made in a hollow tree, and is a large structure made of strips of bark and thin twigs, and lined inside with soft bast, which the squirrel tears off boughs of trees with its teeth. I have also found nests in the roof of a shed, in a plant of the prickly *Bromelia pinguis*, and in an Elk's-horn fern (*Platycerium*) which was suspended by a wire in a plant-house. In this nest was a single young one, which, on the fern having been removed from the house and put in another part of the garden, was found to have been carried away next day by the mother squirrel. The nest in the *Bromelia* plant was quite exposed and only about two feet from the ground, the squirrel trusting to the thorns on the edge of the leaves to protect its young, of which there were two. The little ones were covered with short, smooth, grey fur, and looked very unlike squirrels. *S. notatus* is a bigger squirrel, grey with a red breast. It is less common than *S. tenuis*, but far from rare. It has much the same habits, but does not hang head downwards to feed. Its cry resembles the striking of two pieces of wood rapidly together, and can be heard a long way off. It is easily kept in confinement and readily tamable. *S. prevosti*, Desm., Raffles' Squirrel, one of the most beautiful kinds in the world, is common in the Malay Peninsula, but I never saw it in Singapore. Its brilliant colouring—black, red, and white—makes it very attractive, and it is easily tamed. All these squirrels are most destructive to coco-nuts. Biting round holes in them and getting inside, they soon clean out the flesh; they even sometimes put their nests inside the cleaned-out nut. They also destroy a great deal of other fruits, especially durians. The small boys in Kedah shoot them with stones from pellet-bows made of bamboo.

S. bicolor is a strictly arboreal squirrel which lives in the tops of the higher trees in the thick jungles. It is very variable in colour. The commonest form in Singapore is black with a cream-coloured belly. In the Peninsula it is usually entirely cream-coloured. It is remarkably docile, but much less active than the smaller species. When eating, this species sits transversely on a bough, grasping it with its hind feet, the head and body hanging down on one side and the tail on the other. It eats fruits of different kinds and also buds and leaves.

The red Flying-squirrel, *Pteromys nitidus* (Tupai Belang), is still common in Singapore, inhabiting the thicker jungles. It remains

quite quiet during the day, but at dusk begins to move about. It climbs with some clumsiness to a high point on a tree, and then dives off to the next, up which it climbs again, and again dives off, and so travels to its feeding ground. It appears to be very fond of cocoanuts, and will attack any that are near the jungles which it inhabits.

H. N. RIDLEY.

(*To be continued.*)

II.

Antarctic Exploration.

THE restless activity and love of adventure which characterised the mariners of the Elizabethan era, and urged them on through difficulty and danger to cross the threshold of the unknown and to open up the seas of the world to the commerce of their native land, has lost none of its intensity and is as powerful in the Victorian age as in that of the Virgin Queen. As the area for exploration became less and less, and sea after sea yielded up its secrets, there remained for conquest only the ice-bound waters which surround the poles; and the problem of the "North-West passage" was persistently attacked, until its ultimate solution proved the worthlessness of the quest. Then Nordenskjöld forced his way from the North Atlantic eastward to the Pacific, to be followed by Wiggins, who is still engaged in his life's object of opening a trade route through the Kara Sea to the mighty rivers of northern Siberia, while Nansen, after having conquered the Greenland ice-cap, has embarked on the daring attempt to enter a supposed polar current, and drift with the ice across the Pole itself. So far from the glamour of the Arctic having lost its spell, its votaries are more numerous than ever, and all the maritime nations are pressing northward in a race for the Pole.

Of all these aspirants to polar fame few think of winning distinction for themselves and their country by exploring the seas of the Antarctic regions. Since 1774, when Cook in his wonderful second voyage reached Latitude 71° 10′ S., the 70th parallel of South Latitude has, it is believed, been crossed only twice, namely, by Weddell in 1823 and by Ross in 1842; and, marvellous as were the discoveries of the latter, we cannot but believe that, under the exceptionally favourable circumstances which fell to his lot, had he been possessed of all the appliances of modern science and aided by steam-power, the result would have been infinitely greater. Since that time, with the exception of the brief visit of the "Challenger," which, although possessing steam-power, was totally unsuitable for ice navigation, these seas have been unvisited, and it has been left for commerce to take up the problem where Ross left it fifty years ago: the hope of gain, as on so many previous occasions, has furnished the incentive for work which science was powerless to prosecute.

Under these circumstances, the fitting out of a fleet of whalers for the Antarctic, commanded by experienced ice navigators, and in every way suited for meeting and surmounting the peculiar dangers and difficulties attending such critical work, could not fail to be regarded with the greatest interest by modern geographers and naturalists, especially as it was announced that the surgeons of the vessels had been chosen for their special acquirements as naturalists and had been supplied by the leading scientific societies with instruments and appliances suitable for the investigations which they had consented to undertake. It was therefore hoped that the voyage, notwithstanding its purely commercial object, would yield results of very great interest from a scientific point of view also.

The origin of the expedition was entirely due to the energy of the brothers David and John Gray of Peterhead (11), themselves descendants of a line of ice-kings. They, seeing that the Arctic whale-fishery is rapidly becoming a thing of the past, have for the last twenty years been urging an expedition to the Antarctic seas, chiefly influenced by the reports of the numerous whales identical with, or of a species closely resembling, the Northern Right Whale (*Balæna mysticetus*), which are recorded to have been met with in these seas by Capt. Sir James C. Ross. Neither of the Grays was destined to take a part in the venture. Capt. John Gray is dead, and David Gray could not succeed in fitting out vessels from Peterhead. It therefore fell to the Port of Dundee to make the trial trip; and the "Active," "Balaena," "Diana," and "Polar Star" were fitted out, and sailed from that port about the 6th September, 1892. The Norwegians, ever alert and our keenest competitors in the Arctic fisheries, also sent out the "Jason" on the same venture.

The narrative of this voyage (1) has recently been written by Mr. W. G. Burn Murdoch, an artist who, at his own urgent request, accompanied the "Balaena," by the kindness of Mr. Kennis, the owner, and of Capt. Fairweather. Although rated in the ship's books as assistant surgeon, he was really a passenger. Had Mr. Murdoch's book been descriptive of any other portion of the world save a virtually unknown region, it would have been looked upon in the light of a very amusing production of no scientific value. But any contribution to the knowledge of the Antarctic seas, however slight, is possessed of interest, and the artistic way in which the scenery of this wonderful region is depicted is really of value. Mr. Murdoch is often flippant and too frequently subordinates fact to fancy even beyond the limits of poetic license, but there are occasional little bits of descriptive writing which are both truthful and poetic.

The "Balaena," a barque-rigged vessel of 417 tons gross burden, and 65 horse-power auxiliary screw, commanded by Capt. Fairweather, an experienced and successful whaler, left Dundee on the 6th of September, 1892, with a crew of 45 all told. Her passage south

was much delayed by bad weather, and the 21st of September found her barely clear of the Irish Coast.

On the 24th of November, in Lat. 40° 39′ S. and Long. 48° 57′ W., "many hundreds of small whales or porpoises" were seen travelling south; "they resembled the American drawings of the pigmy sperm, but had a larger dorsal fin" (p. 141). Mr. Murdoch remarks in a footnote that on the return voyage in the following March a similar abundance of apparently the same species was met with nearly in the same position, and adds that "Almost all the whales and porpoises we saw south of the line on our voyage out were travelling south or south-east, and those we saw on the voyage home were travelling north with their young. . . I conclude they have a grand nursery down in the ice, where they bring forth their young in the Antarctic summer, and come north when the winter sets in." The whales seen in such numbers were probably a species of Ziphioid, which would appear to be as strictly migratory in these regions as its relative in the Northern Hemisphere.

Many birds were seen about the 1st of December as the ship approached the Falkland Islands; but unfortunately, owing to the author's hurried exodus from Edinburgh, and we presume also that of his companion, the "Naturalist" of the "Balaena," he was unable to bring books on bird life in the South Seas, and therefore was only able to give them names by which they would scarcely be recognised by "scientists" at home. Stanley Harbour in the Falkland Islands was reached on the 8th of December, and here bird life seems to have been varied and abundant: "hundreds of divers and ducks scurried over the dull green water, splashing and diving—waiting at times till we were nearly on the top of them before they moved away. Gulls and petrels flew from the shores and circled round our masts—strange, unfamiliar, silent birds, with a quaint, old-world look and odd colours, as if they had been designed for a pantomime, or had just flown out of a Noah's Ark. Some of them were the gigantic petrel, I think—big, clumsy birds, nearly as large as an albatross, with coarse feathers of a raw chocolate colour, and big, yellowish beaks; some of these birds were almost entirely white. Some of the gulls were like our black-backed gulls, with a band of red on their yellow beaks. There were also molly mauks, and a pretty gull of a French-grey colour, with black wing-covers with white edges, and brilliant red beak and legs. Besides the petrel and gulls there were many kinds of divers and ducks, white-breasted shags, and several varieties [*sic*] of penguins. The last only showed their heads above water, as our cormorants sometimes do at home. Sometimes schools of them leapt clean out of the water, making black-and-white half circles in the air, popping in again with hardly a splash. Such an island is a naturalist's paradise"—to reach which who would not brave the stormy seas about the Horn?

The "Balaena" remained at Port Stanley until the 12th of

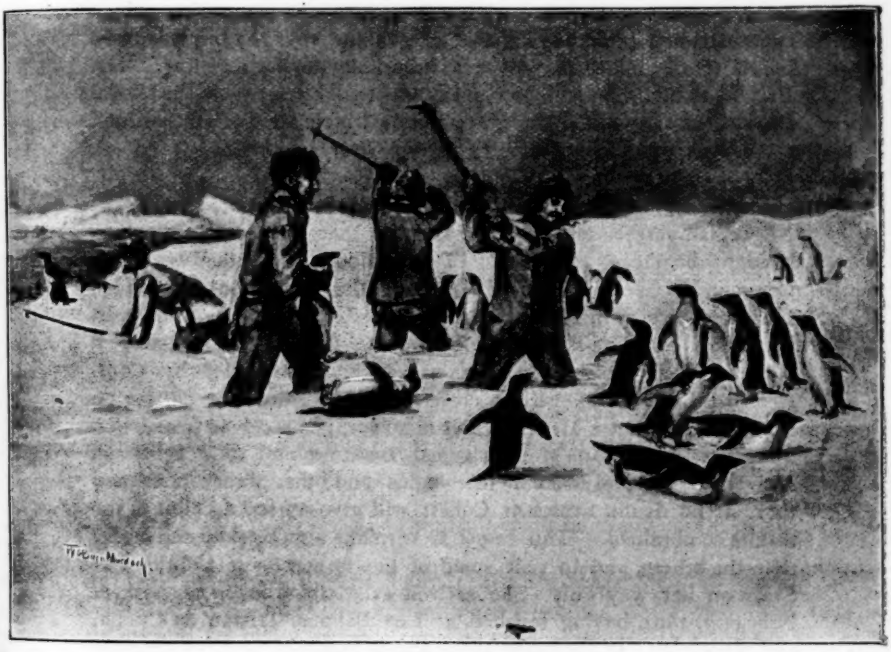
December, during which time several excursions inland were made and some good birds obtained, including the curious Steamer Duck *Tachyeres cinereus*. The author speaks of the ground being covered with "heather," but corrects himself: "it was not heather on which we reposed, but *Empetrum rubrum*, which is much the same at a distance, and is a sort of crowberry . . . Diddle Dee is its local name. I have a list of other plants of the islands—splendid names—*Gidmardia australis*, *Bostkovia grandiflora*, and the like, and I feel tempted to throw in a number here, but refrain. Neither does my companion [the Naturalist of the "Balaena"] approve of such inexpressive, unpopular names. Science is meant for all, not the few, he says, and we should call a spade a spade and not a bally shovel as the Bishop remarked"; and this notwithstanding the author's expressed difficulty in enabling the "scientist" to recognise the birds met with on a recent occasion, through ignorance of any but their popular names.

The Falkland Islands[1] were left on the 11th of December, on the 15th the "Balaena" met the first sheath-bills, and the next day in the afternoon the lifting of the mist disclosed to view a huge island of ice estimated to be half a mile long and 200 feet high, "the top as level as a billiard table." These typical Antarctic bergs soon became common enough, and were sometimes many miles in extent; their beauty and delicate tints of colour are described as passing conception. On the 17th the first seal was shot, the "crow's nest" was sent up, and on the 23rd the first outlier of the Antarctic continent in that longitude, one of the group of Danger Islands, was made. The whale lines were now coiled into the boats and a lookout set for the Right Whales that never came; any number of Fin Whales of various species were seen, but the main object of the long voyage was never discovered.

The numerous penguins were a constant source of interest and amusement. They were stupid in the extreme; instead of seeking safety in the water, they invariably jumped upon the ice, and even if forcibly thrust into the water returned to the charge totally unaccustomed to the new danger, fearing man probably less than the aquatic enemies which hitherto had been their only foes. Three or four species of penguin were seen, including the giant "Emperor" of which several were killed. Unfortunately the smaller penguins were found to be fairly good eating, and great numbers of them were killed. The enormous destruction of these defenceless birds that is the invariable concomitant of all these expeditions, scientific as well as commercial, must awake in the naturalist sad fears for the speedy destruction of the whole order.

[1] The reader will be glad to learn that the Company's coal-ship, about which the Agent was so anxious, was not 101 days "over-due" but 101 days out; it will also be a relief to him to learn that the Glasgow ship, the crew of which were "dying one by one" from scurvy, sailed three days after the "Balaena," having lost only one man.

On the 23rd of December the "Balaena" was joined by the "Active" and a few hours later by the "Diana"; the "Polar Star" put in an appearance subsequently, as also the "Jason." Presently seals were found to be numerous, and Capt. Fairweather, although practically unrestricted in his actions, finding that there was no chance of meeting with Right Whales, cleared the boats of their whaling gear and availed himself of the only opportunity of making his voyage a paying one. For this the Captain of the "Balaena" is severely taken to task by Mr. Murdoch, and doubtless it was disappointing enough to turn from the chances of new discoveries to the pursuit of "blubber";



THE MASSACRE OF THE PENGUINS.

The block kindly lent by Messrs. Longmans, Green & Co.

but Mr. Murdoch was fully aware of the commercial character of the voyage and had no reason for complaint. His question—"Is it not a hideous marvel that Dundonians should show such splendid enterprise as to send four ships out here for whales, and at the same time show total disregard for the scientific possibilities of such a cruise?" is singularly out of place when Mr. Bruce and himself had berths in the "Balaena"; while his severe strictures on Capt. Fairweather's ignorance and cupidity (p. 244) are scarcely borne out by the fact that the only two birds which reached the British

Museum from the expedition were the gift of the commander of the "Balaena."

At last, on the 18th of February, 1893, the vessel bore up for home, and reached Dundee on the 30th of May, having a cargo of 5,226 seals. The rest of the fleet also arrived safely, the "Active" with some 4,000 skins, the "Diana" with 3,572, and the "Polar Star" with 1,908, a total of 14,706. The commercial result of the voyage was not such as to encourage a repetition, and the Scotch vessels did not return to the Antarctic, leaving the field entirely to the Norwegian ships.

Appended to Mr. Murdoch's book is a chapter by Mr. W. S. Bruce, who accompanied the "Balaena" as Naturalist, which contains some remarks on the results of the voyage; but it is to be hoped that a fuller account will eventually be forthcoming. Mr. Bruce and Mr. Donald have also contributed papers to the Royal Physical Society of Edinburgh (4 and 6), which are both interesting, as well as preliminary reports in the *Geographical Journal*, vol ii., pp. 430 and 433.

Although the Scotch owners abandoned the Antarctic sealing, the Norwegian vessels, which are worked on a more economical principle, have by no means done so. In the middle of September, 1893, Commander Svend Föyne of Tönsberg, the proprietor of the noted Finwhale Fishery in Finmarken, despatched one of his sleuth-hounds, the "Cap Nor," re-christened for the occasion the "Antarctic," a barque-rigged vessel of 226 tons register, commanded by Capt. Leonard Christensen, with a crew of 26 all told. She carries no scientific staff, but a Mr. Bull, her manager, has received instruction from the Norwegian Meteorological Institute and the Christiania University, and will make meteorological and other observations, and there is no doubt Professor Collett will give a good account of the results so obtained. This vessel is to make a more extended cruise than the others, and to visit some of the former haunts of the Fur Seals on her way out. She arrived at Melbourne on the 27th of February, 1894, having touched at Les Palmas, Tristan da Cunha, and Kerguelen; at the latter place she is reported to have run into Greenland Harbour and visited Royal Sound, where a colony of 59 persons was found, consisting of Europeans, Chinese, and Indians, but there were no Fur Seals. She was to sail for the south in November and to search for open water between 75° S. and 78° S., in hopes of finding whaling grounds.

The "Jason" returned to the Antarctic Seas last season accompanied by two other Norwegian vessels, the "Castor" and the "Hertha," with the "Orion," which remained at Port Stanley as a store ship. They returned to the Falkland Islands from the south on the 12th of January, 1894, having seen an enormous number of seals, which, owing to the broken condition of the ice, it was impossible to approach. They there discharged their small cargoes into the

"Orion" and again went south. On their return to Port Stanley they will winter there, while the "Orion" will bring home their catch.[2]

Some interesting extracts from the journal of Capt. Larsen are reproduced in the *Geographical Journal* (9), showing that he had succeeded in reaching 68° 10′ S. and Long. 60° W., while one of the other vessels reached 69° S. further to the west, very considerably extending the knowledge of the Antarctic regions in that longitude. Most interesting particulars are given of the animals and birds met with at several places where a landing was effected. Unhappily, Capt. Larsen is not a zoologist, or his observations would have been most valuable. On one occasion in Lat. 64° a hawk was observed, penguin rookeries (species not given) were visited, numbers of *Blaahvaler* (Blue whale), the name by which *Balænoptera sibbaldi*, Gray, is known to the Norwegian whalers, were seen, also a *Knarhval* (of course not *Monodon*, but probably *Megaptera longimana*, the Humpback whale); "small fishes with big eyes and a bright skin" were seen in Lat. 66° 4′ (can they have been a species of *Maurolicus*?), also small whales supposed to have been *Minkehvaler*, by which name *Balænoptera rostrata* is known to the Norwegians. Emperor Penguins were very numerous in the fjords in Lat. 67° S.; and on December the 5th, in Lat. 67° 13′ S., Long. 60° 16′ W., what was believed to be a *Rethval*, Right Whale (*Balæna*), was seen to blow but was soon lost sight of; this was the only instance during the voyage in which a *Balæna* was supposed to have been sighted. A small volcanic island in full activity was observed and landed upon on the 11th of December, 1893, about 65° 5′ S., 58° 40′ W. Capt. Larsen and his first mate proceeded about four English miles on this island, which they called Christensen Island. He says "the seals lay in places so closely packed that we had to make circles in order to advance. It was delightful to see those masses of animals, most of which proved to be youngsters of the *Fiskesæl* [species ?], which already had changed their hair; they were beautifully fed and looked like so many bulls. Here and there an old animal was amidst the youngsters. The seals were not a bit afraid of us; on the contrary, they stretched their flippers towards us as we pelted them." On Middle Island in the bare places "the soil was covered with moss." After a fruitless visit to the coast of Chili, the ships went to Port Stanley to discharge their skins and to take in coals for a fresh journey southward, finally returning to the Falklands on March 15th, 1894.

The chief result of the visits of these vessels is a considerable extension of our knowledge of the geography and configuration of the northern extremity of Graham's Land and of the adjacent islands included between 47° and 60° West Longitude and 63° and 68° South Latitude. These discoveries are laid down in a map published in the

[2] I am told that, on her return voyage, the "Orion" got aground on the Goodwin Sands, but with what final result I have not heard.

Geographical Journal illustrating the voyage of the "Jason" (9), and need not be further referred to here. The object of the vessels was to find whales and seals, and for this purpose they would not leave the ice margin, as open water would be barren for them; the commercial interests of the voyage would therefore prevent them taking advantage of likely openings for purposes of exploration; if the two could have been done together well and good, if not the latter must give way to the exigencies of the former.

Of course the object of this search, the Cetacea, possessed the greatest interest in the eyes of the visitors, but their hopes of finding any member of the family Balænidæ were soon disappointed; various Balænopteridæ (Fin Whales) were very abundant, but on only one occasion was it even surmised that a Right Whale was seen. After Ross's repeated assertions that he had seen great numbers of the largest sized black whales lying about upon the water in all directions, this was a grievous disappointment. The ships were in the same latitude and longitude as Ross, and on the same day of the year, but not a Right Whale was seen. Ross also speaks of the sea being full of marine invertebrata upon which the whales were feeding, amongst them *Clio borealis*, which with "rice food" (*Calanus finmarckicus*) constitutes their principal diet in the Arctic seas. Capt. Gray was told by an old whaler, trained by himself, who was on the "Diana," that no "whale's food" such as is met with in the Greenland seas was on any occasion seen by him. This in itself, if normal, would account for the absence of the whales; but it seems incredible that such a change should have taken place since the year 1840 in the character of the lower forms of life inhabiting the same sea. What are we to think then—was Ross mistaken, and did his characteristic description of the Right Whale, an animal which must have been well known to him, really originate in a mistake as to the species? It is impossible to say, but the facts remain that neither the Right Whale nor its food were met with, though large Fin Whales and the *Euphasia* which forms their proper foods warmed in the water. Unfortunately, those present were not sufficiently acquainted with the characteristics of the various Fin Whales to speak with certainty as to their species, and none were captured; it is therefore useless to add anything to what has already been said on the subject, further than that a species of *Orca* was also met with in abundance.

Failing whales, the commanders of the vessels turned their attention to the seals, which were exceedingly numerous. No new species were found, nor any of the Otariidæ. The four species were the Sea Leopard, *Stenorhynchus leptonyx* (de Blainville), Weddell's False Sea Leopard, *Leptonychotes weddelli* (Lesson), the Crab-eating Seal, *Lobodon carcinophaga* (Gray), and Ross's large-eyed Seal, *Ommatophoca rossi* (Gray). Weddell's Seal appears to have been the least frequent. Mr. Bruce (4) gives some interesting particulars of the habits of these beautiful creatures: they leave the ice about 7 p.m. to feed, returning

about 9 a.m. to bask in the sun during the day; in December they were all in bad condition but improved during January, and in February were very fat; their food consisted of fish, small crustaceans, and an occasional penguin. In February the embryo was well developed, and almost every female examined was with young. The seals were perfectly fearless of man, and offered no resistance to the sealer, simply waiting their turn to be killed. If the present indiscriminate slaughter of both sexes goes on, there is not the slightest doubt that at no distant period the true seals (Phocidæ) of the Antarctic seas will be as completely exterminated as are the millions of Fur Seals (Otariidæ) which formerly inhabited the islands of the Southern Seas. It is sad to think that our increased knowledge of the Antarctic seas should be purchased at such a price.

Of the fishes we learn next to nothing. Mr. Murdoch (1) gives a sketch on p. 255 of a small fish, which he describes vaguely enough as "something between a whiting and a gurnard," a large number of which were taken from the stomach of a seal; and Capt. Larsen, who found apparently the same fish under like circumstances, calls it a *Kvitting* (Whiting). Ross (13, vol. ii., p. 160) killed a seal in 95° S., 155° W., from the stomach of which he took 28 lbs. weight of fish of two kinds, "one a *Sphyræna*, the other a *Notothenia*"; they were very much mutilated, but sufficient material could be found to enable Sir John Richardson (14, part ii., page 8) to describe the latter as a new species under the name of *Notothenia phocæ*; it seems not improbable that this was the fish found by Capt. Larsen. The possible examples of a *Maurolicus* have already been alluded to; and this is all the information given with regard to the fishes.

Of the marine invertebrates even less is said, a red shrimp which was also found abundantly by Ross being about the only form mentioned.

Of the birds, fortunately, more information was obtained; but the material brought home was not in a condition to be of the greatest service to science, and very few of the specimens were deposited in the National Collections. A specimen of the Emperor Penguin has come into the possession of the Museum of Science and Art at Edinburgh, and Capt. Fairweather of the "Balaena" presented examples of *Larus scoresbyi* and *L. dominicanus* to the British Museum. Mr. Murdoch (1) laments (p. 244) that "common albatross skins were collected by the score, and rare penguins killed by the hundred, their bodies eaten, and their skins chucked overboard. Emperor Penguins, King Penguins [?], an endless variety of birds, some unheard of [?], all go over the side because they are supposed to be of no commercial value." Surely some of these skins so little valued might have been rescued by Mr. Murdoch and his friend. Professor D'Arcy Thompson, who seems to have received most of the material brought home, and by whom it is hoped that some report will in due time be published,

sent thirteen skins, which had been presented to the Museum of the Dundee University, to Dr. Sclater, who has contributed a short paper to the *Ibis* on the subject (7). They consisted of eleven species with "no original dates or localities attached to them, but are nearly all of birds that may well occur in the 'Antarctic Seas,'" none of them are new species. Quoting Dr. Donald's paper in the *Scottish Geographical Magazine* for February, 1894, Dr. Sclater states that 20 species in all were met with, and calls particular attention to two birds mentioned by Dr. Donald. The first was a "Hooded Crow," which appeared to resemble closely the "ordinary Carrion Crow"; this was seen on three occasions, twice picking "at a dead seal on the shore and the third time on the wing." The second bird referred to was a "black and white Duck." Of these Dr. Sclater says, if the former were really a Corvine bird it will probably be a new species, as no such bird is known in Arctic America, and the latter may be a species of *Bernicla*. Of course the most interesting birds, and at the same time by far the most numerous, were the penguins and petrels. Of the habits of the former Dr. Donald gives some very interesting particulars in another paper (6). He mentions the difficulty he experienced in killing these large birds, a difficulty also experienced by Ross, and it may be well to mention for the benefit of future explorers that the latter found a "tablespoonful of hydrocyanic acid accomplished the purpose in less than a minute" (Voyage II., p. 158). Capt. Larsen states that at Cape Seymour he saw "a species of land-bird, belonging to the Rapaces, which resembles our hawk; it occasionally came down and pecked some eggs."

Botany seems to have been totally neglected. Capt. Larsen, who appears to be a very intelligent observer, incidentally remarks that on one of the islands where the snow was blown away "the soil was covered with moss." A fucus I think, is also mentioned somewhere; and the sea and ice were in places stained by diatoms. Doubtless more trained observers would have found other signs of vegetable life; but in this respect as in others the country must have been a complete contrast to the corresponding regions of the North, where the soil left bare by the retreating snow speedily bursts forth into a garden bright with beautiful flowers. Nor is the absence of animal life less remarkable: where are the Musk Ox, the Fox, Arctic Lemming, Reindeer, Bears, and Walrus, White Whales and Narwhals, some of which are found as far north as man has penetrated, and which afford sustenance to a race of hardy native hunters all round the pole? At the antipodes the species are few if the individuals are numerous, and man is conspicuous by his absence.

There is much yet to be learnt with regard to the Antarctic regions, and it will only be accomplished by trained observers, men who know what to look for, what is worth collecting, and what conditions must be observed to render their collections of service to the

specialists who will eventually have to deal with them. It is gratifying therefore to learn that, as a result of representations made by the Royal Geographical Society, the Royal Society appointed a committee to report on the subject of Antarctic exploration, and that it has issued a most favourable report showing the great value of Antarctic Expeditions both practically and scientifically, also that a resolution has been passed by the Council of the British Association strongly in favour of the work taken in hand by the Geographical Society. This could not be otherwise after the address delivered in November, 1893, by Dr. John Murray on the Renewal of Antarctic Research (2). Furthermore the Agents-General of the Australian Colonies have been approached on the subject, and in due time a deputation will be formed to represent the matter to H.M. Government with full details as to the cost of an expedition. The President of the Geographical Society speaks hopefully, but adds the caution that we must all put our shoulders to the wheel. Let us hope that the end will be a success.

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T. SOUTHWELL.

10, The Crescent, Norwich.

III.

The Continuity of the Protoplasm in Plants.

WITHIN comparatively recent years a profound change has come over our conceptions of plant organisation. Previous to the year 1883 we find it stated in the Physiological text-books that: The life of a higher plant is the sum of the separate life-activities of its component cells; or that "To many, the cell is always an independent living being, which sometimes exists for itself alone and sometimes becomes joined with others—millions of its like—in order to form a cell-colony, or, as Häckel has named it for the plant particularly, a cell-republic." (Sachs' Lect. Physiology.)

To-day we can no longer regard these assertions as strictly true.

It has been found that the cell-walls which were supposed to mark the limits of the component individuals of a multicellular plant are not intact, but that, on the contrary, they are covered at definite points with numerous perforations through which fine filaments of protoplasm run, connecting together the protoplasmic bodies of adjacent cells.

Thus the protoplasm of a many-celled plant, as that of a single-celled individual, forms one mass; and the phenomenon of cell-wall formation points, not to the compound nature of the plant, but to an adaption by means of which the protoplasm may attain a large extension without losing its coherency, and through which it obtains, moreover, both a support and a protection from external dangers.

When the doctrine of the continuity of the protoplasm throughout the plant body, or at least throughout large areas of it, is realised, many problems which were difficult to explain find a ready elucidation. In this respect we may particularly mention the transmission of stimuli from cell to cell. For instance, if the terminal leaflets of a compound leaf of the well-known sensitive plant be touched, these will close together; but the response does not end here; on the contrary, the stimulation will be communicated from leaflet to leaflet until it reaches the base of the whole leaf, which will in consequence become depressed. There is little doubt that it is the living protoplasm which is the active agent in this phenomenon of transmission; but, on the supposition of the isolated nature of the protoplasmic bodies of the separate cells, it is not clear how the stimulus is conveyed from cell to cell. With the knowledge of the continuity of the protoplasm before

us, the difficulty vanishes, for we then perceive a direct channel of intercommunication in the delicate threads of protoplasm which traverse the wall from cell to cell, and which play a part in some repects roughly comparable to that of the nerve-fibres in our own bodies.

To understand so important an alteration in our ideas as that indicated above, the best plan will be to state the various steps which the movement has taken since its inception.

In 1854 Theodor Hartig (1) studied those peculiar structures, the sieve-tubes, which occur in the phloem. He found here that the protoplasmic bodies contained in the several elements of a tube were not distinct from each other, but that each was connected with its neighbour by a number of small strands of protoplasm which ran through perforations in the transverse septa of the tube. This is practically the first recorded instance of a connection discovered between the protoplasmic bodies of neighbouring elements.

The matter rested here for twenty-five years; it was not until 1879 that Dr. Edward Tangl (2) discovered continuity in other structures than sieve-tubes. He studied the endosperm cells of certain seeds, and was able to demonstrate the existence of a communication between the living contents of the various cells. The material he used for the most part was *Phœnix* and *Strychnos nux-vomica*. Mr. Spencer Moore, a few years later, showed continuity in most of the other species of *Strychnos*.

In 1882, Professor Strasburger published his famous work on the cell-wall (4), and we find recorded here both a confirmation and an extension of Dr. Tangl's observation. It was Professor Strasburger who first, in the above-mentioned monograph, called attention to the curiously perforated, sieve-like membranes closing the channels of the pits in the thickened cell-wall.

In the same year a new worker came to the fore in the person of Mr. Walter Gardiner (5), and it is to him more than to any other single worker that we are indebted for the establishment of the important doctrine of continuity. So far we had only possessed definite knowledge with regard to the passive reserve-cells of seeds; but Walter Gardiner turned his attention to the vitally active portions of the plant, and was able to show here also a distinct continuity between the protoplasmic contents of the different cells. He found it to be the case in the cells of the bast-parenchyma, the pulvini of leaves, the cortical tissues and the stamens of *Berberis*. Not only does he give us an account of the facts observed, but he also points out the significance which they possess. In the case of endosperm cells, he believes we have an adaption which permits of the ready transference of nutritive materials and unorganised ferments from place to place; in functionally active cells we have, he thinks, channels along which stimul can be transmitted from the protoplasmic mass in one part to that of another. "For instance,"

he says in his memoir, "there can be little doubt that the conduction of a stimulus, which can be readily observed in the leaves of *Mimosa pudica*, is effected by this means."

In the next year, 1883, observations had been brought so far that both Gardiner (6) and, a little later, Professor Schaarschmidt (12) were enabled to venture the opinion that continuity of the protoplasm was not an exceptional phenomenon restricted to the comparatively few cases noticed, but one which was universal in vegetable cells. All subsequent facts tend to confirm and strengthen this view.

The year 1883 was in every way an important one for the establishment and extension of the doctrine; the numerous publications which then appeared show that the idea had taken a firm hold of the leading botanists of the day. Russow (8) had already published a memoir on the subject, in which he expressed his belief in the active part played by the connecting filaments in transmitting dynamical stimuli. Professor Hillhouse (10) published a paper in which he showed continuity to exist in the cells of the bases of many leaves (*Prunus laurocerasus*, *Æsculus Hippo.*, *Ilex*, etc.). Schmitz (9) issued his well-known work on the Florideæ. Here also he could demonstrate the existence of protoplasmic intercommunications. Schmitz, however, was not quite the first to point out continuity in the Florideæ; before him, Mr. Archer had noticed a connection between the protoplasmic bodies of the cells of *Ballia callitricha*, and Professor Percival Wright between those of *Polysiphonia* and *Griffithsia setacea*. Both Messrs. Archer and Wright spoke of the continuity as being direct through an open pore, and they also considered it to be only a temporary connection which became broken at a later stage in the history of the cell. Professor Schmitz and Gardiner are led to believe that the continuity is both permanent and not direct but indirect. That is to say, they think the continuity is effected not by a single thick strand of protoplasm running through an open pit, but by a number of delicate filaments traversing a porous membrane (pit-closing membrane) which stretches across the pit or canal in the cell-wall. It may be mentioned here that it is Gardiner's belief that continuity is in all cases indirect, never direct. Mr. George Massee, who has studied the subject in two species of *Polysiphonia*, thinks that continuity is direct in the early stages, but that a sieve-like diaphragm is subsequently developed across the pit.

In a paper read before the Linnean Society in 1885 (16), Mr. Spencer Moore gave an account of his work on continuity in some Florideæ. He also believes that the connection is direct in the young cells, but that later it sometimes becomes indirect, while at other times it remains direct throughout life. "The young cells," he says, "are placed in communication by means of a fine filament, upon which is, in most cases, placed a small nodule, just as a bead is strung upon a thread." Both thread and nodule grow, the latter assuming the form of a ring; the protoplasm, encompassed by the nodule, gives rise to

a delicate closing membrane, which stretches across the ring transversely, and in which there either remains a single central pore, or several of these scattered over its surface; in the latter case we get a sieve-like diaphragm interposed. Mr. Hick, in 1884, published a work on continuity in the Florideæ (14), and in 1885 he issued another paper wherein he showed the existence of protoplasmic communications in several species of *Fucus* (15). In 1884 Terletzki (13) and Schaarschmidt (11 and 12) noticed continuity in certain ferns.

The above is a brief sketch of the chief landmarks in the history of the doctrine of protoplasmic continuity; there are many more published articles and memoirs on the subject, but it is believed that these, excellent as many of them are, do not mark the decisive steps in the establishment of the principle that most of those here mentioned do. The complete literature can be gathered together from references in the works quoted at the end of this note.

It will be perceived that there is very good reason for believing in the universality of the phenomenon, and a little reflection will show the significance which such an intercommunication of the living substance has for the plant.

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IV.

The Structure and Habits of Archæopteryx.

I.—An Explanation.

WHEN in Berlin during the past summer, I learned with deep regret that my words in an article in this Journal (October, 1893) had been interpreted as an accusation of deliberate falsehood against certain distinguished palæontologists, and on reading isolated sentences in that article I am bound to admit that they are open to such a construction if the reader chooses to ignore the whole tenour of the article. The object of the article was to show how errors arise and are multiplied, and I attempted to show that it was possible for the most distinguished men to fall into error when their minds were not entirely free from an unconscious bias. Under the influence of such a bias or dominant idea, alterations are deliberately made in drawings or descriptions in such way as to remove what appears under the influence of such a bias to be misleading. I need not here repeat my argument to show that the figure which I described as "spreading like a plague" had been altered *deliberately* in order to remove an apparent absurdity; or, in other words, to show that the errors in that figure are not such as are made by a professional woodcutter and passed over undetected by an author. That the figure was thereby rendered altogether false and misleading, I asked my readers to prove for themselves by comparing it with the photograph with which the article was illustrated.

I cannot now do less than express to Professors Steinmann and Döderlein my sincere regret that such an unfortunate interpretation has been put upon isolated sentences in my article, and assure them I aimed only at showing that they, *with the most honest intentions*, had so manipulated a drawing as to make it worthless and misleading, and that in this they had only fallen into an error to which we are all alike liable. In spite of what certain English correspondents have written to more than one German professor on the subject, I deny altogether that I have made any charge of dishonesty against any person whatever. The paragraph commencing near the bottom of p. 280 shows my meaning so clearly that I am astonished that anybody should put a wrong interpretation upon it, or at least that any Englishman should.

II.—The Skeleton of Archæopteryx.

It will be noticed that the present article is not one of my series upon Biological Theories, and it has nothing to do with my contention in a previous article on the origin and multiplication of errors.

Apart from a single feather, only two specimens of *Archæopteryx* are known, and it is possible that these may not be identical in species or even in genus. So far as we know them, the differences between the two appear, to those who are best qualified to judge, to be too small to justify separation into two species. Though both were found in Bavaria, I shall refer to them as the "Berlin specimen" and the "London specimen" respectively.

It is not convenient to begin with a description of the external form of the bird, as is customary with recent species, for that external form can only be guessed at with reasonable chance of guessing accurately after a careful consideration of the structure of such parts as are still preserved. This is even more conspicuously true of the habits of the animal.

Of the skeleton, if we assume the two specimens to be so nearly related that the characters exhibited in either may be taken as true of both, we have quite an extensive knowledge.

The **vertebral column** is readily divisible into four regions: cervical, trunk, sacral, and caudal. Whether the vertebræ are fully ossified or not it is difficult to say. I can find no justification for the statement that they are amphicoelous. Professor Dames tell me that his statement to that effect is a mere slip of the pen, and that he intended only to say that, so far as can be seen in a specimen in which the vertebræ are still in their natural relations with one another, the ends are flat and not, as in most birds, saddle-shaped. The central or internal part of each vertebra in the London specimen is stated by Owen to be represented by a deposit of crystalline "sparry matter" in the caudal region, while the outer "crust" has adhered to the upper slab or "counterpart." Whether this really shows that the vertebræ (of the tail) were mainly cartilage or other soft tissue with only a crust of bone or not, may be open to question. The perfectly-fitting joints, the large transverse processes of the anterior caudal vertebra, and the slenderness and stiffness—as shown by the straightness of the tail in both specimens—of this region of the vertebral column are strong evidence that the bones were *well-ossified*.

Of the nine **cervical vertebræ**, only eight are well-preserved, the first being almost unrecognisable. Measuring the lengths of the centra of these on a large photograph (scale $\frac{138}{181}$), I make the sum of the eight in the Berlin specimen to be about 75 mm.; but Professor Dames gives numbers which together make only 60·5. A glance at the plate will show the position of the neck in this specimen. It is

very strongly arched so as to bring the head almost into contact with the back of the animal in the region of the thorax. It is difficult to make these measurements accurately in either the specimen or the photograph, but the discrepancy between the two measurements is too great to be accounted for by this difficulty, and I suspect that Professor Dames' measurements have been made along the inner curve—*i.e.*, through the neural spines—while mine were made near the ventral curve, *i.e.*, through the centra of the vertebræ. I suspect, therefore, that when the animal's neck was straightened out it would be 75 mm. long in addition to the length of the atlas, which may be taken to be a very small quantity as in modern birds. Of the nine cervical vertebræ the middle ones are longer than those nearer the ends of the neck, the fifth being the longest.

Cervical ribs, apparently movably articulated, may be made out, and there appear to be eight pairs of them. The neural arches and spines are well-developed and strong, the spines being 2 to 3 mm. high.

The **trunk vertebræ** being somewhat displaced, and the vertebral column distorted, it is not very easy to make sure of their number. There appear, however, to be ten, measuring together about 70 mm. The vertebræ appear to be almost equal in size, and nine of them bear **ribs.** There are also **ventral ribs**, resembling the "**abdominal**" **ribs** of the geckos and chamæleons, and clearly showing the ventral boundary of the abdominal cavity (*see* 14 in Plate).

The **sacrum** is hidden in the Berlin specimen except at its ends. It measures 26 mm. in length. It is probable that there are about seven sacral vertebræ.

The **vertebræ of the tail**, twenty in number, measure together about 170 mm.—slightly less perhaps. The first few are very short and stout, each measuring about 4 mm. in length and 4 mm. in height. The first four have well developed transverse processes; in the fifth this process is not well preserved, and the vertebræ behind this have no transverse processes, but only a ridge. The vertebræ are longest nearer the middle of the tail, the eleventh measuring nearly 12 mm. The tail as a whole seems to have had little flexibility, for it is almost perfectly straight in both specimens. The tail of the London specimen has apparently only eighteen vertebræ and measures 180 mm.

The **skull** has been much further exposed since the photograph was taken. It is large and fairly massive, the jaws are stout, and teeth are very easily made out in the upper jaw. Those of the lower jaw are, however, hidden by those of the upper, and it is impossible to say at present how many there were (*see* Fig. 1). The sclerotics are ossified. The hinder part of the skull is destroyed in the Berlin specimen, and it is worthy of note that the cranial cavity was not filled with matrix. No part of the skull is recognisable with certainty in

the London specimen, though it may be that the supposed cast of the brain (!) shown at *b*, in Fig. 2, is a portion of the skull.

The **ribs**, both vertebral and ventral, are very slender. There are no uncinate processes visible.

Of the **sternum** nothing is known, though much has been written. In the Berlin specimen it probably lies still hidden in the matrix. The position of the ventral ribs shows that it must have been small.

The **scapulæ** in the Berlin specimen were broken in exposing the specimen. The right one is easily recognisable in the plate. They are flat curved bones, not unlike those of a modern bird. Their length is 43 mm. or thereabouts, according to Dames. In the photograph only a portion is seen.

The **coracoids** are in the Berlin specimen largely hidden. I have not specially examined what portion is exposed in the London specimen. The dorsal ends are exposed in the Berlin specimen and possess a furcular tuberosity as in other birds.

FIG. 1.—The Skull of *Archæopteryx*. After Dames. (*Natural size.*)

Of the **furcula**, a small portion is seen at the left shoulder of the Berlin specimen. It was, however, imperfectly exposed at the time when the photograph was taken. A larger portion is seen in the London specimen. It is a characteristically avian furcula, U-shaped ventrally, and articulating with the furcular tuberosity of the coracoid at each shoulder.

The **humerus** is a well-developed bone in each wing. Its form and dimensions may be seen in the plate of my former paper (vol. iii., p. 275), as also in the one accompanying the present communication. In the London specimen the inner surface of the right humerus (called "left" by Owen) is seen on the right side of the specimen (see *h'* in Fig. 2), while both are seen from the outer surface in the Berlin specimen. It differs from that of other birds in being devoid of the pectoral crest or ridge for the insertion of the great pectoral muscle. As Dames points out, this confirms his view that the sternum must have been small, as must also the great pectoral muscle. In the plate illustrating my previous article the proximal end of the humerus is covered by a portion of the matrix, which has since been removed (at 11 in Plate I. of the present article), and that plate consequently gives an impression of a

FIG. 2.—The specimen of *Archæopteryx* in the British Museum. About ¼ natural size. Explanation of letters:—*l*, portion of second (?) wing-digit, with claw; *cr*, metacarpals IV and V (?); *u*, *u'*, ulna; *r*, *r'*, radius; *h*, *h'*, humerus; *sc*, right scapula; *fu*, furcula; *c*, ribs (partly ventral); *l*, feathers; *i*, right innominate bone; *a*, acetabulum of the same; *f*, *f'*, femur; *t*, *t'*, tibia; *mt*, metatarsus; *p*, phalanges of left foot; *b*, supposed cast of brain. The accented letters refer to bones of the right limbs.

The block kindly lent by Dr. H. Woodward, F.R.S.

humerus which is slightly shorter than the true length. It unfortunately has given rise to the supposition that I "retouched" the photograph before sending it for reproduction—which, of course, is not true.

The bones of the fore-arm seen in the plate facing p. 275 of vol. iii., and on p. 351 of vol. v., and in Plate I. herewith, are a straight **radius** 55 mm. long, and a *curved* **ulna** 56 mm. long.

The **carpus** offers great difficulties. Owen figures two bones, one of which is visible in the London specimen. Why he should ignore the enormous ulnar carpal, which is a conspicuous object in the London specimen, need not here be discussed, as I am not *now* discussing the origin of errors. It is conspicuously shown in fig. 2 and in plate i. of Owen's memoir, where it is numbered 56′ and described (presumably with the radial carpal) as "left carpus" (it being of course a part of the right carpus), and something wholly unlike it is put in its place, in dotted lines, in his second plate in the figure which is reproduced as Fig. 2 (p. 439) of Mr. Pycraft's paper in the last volume of this Journal.

Of these bones I have seen two clearly, one being the radiale (4 in Plate I.), which is visible in both the specimens, the other the "ulnare," visible only in the London specimen. In the Berlin specimen the carpus lies radial side uppermost, and it is not surprising that, like some other parts, the ulnar portion of the carpus lies still embedded in the matrix. This is even admitted by Dames. The little bone called "ulnare" and drawn from imagination by Owen, and also drawn by Dames, may or may not be present. I have tried, and failed, to make it out in the Berlin specimen, and I have also tried, and failed, to make sure that it is not there. One thing only I can say of it, viz., if present it is probably the *intermedium*, and not the ulnare. The "ulnare" is the enormous and conspicuous bone shown at the distal end of the right radius and ulna in Fig. 2. It is, for a carpal bone, of enormous size, and I am not prepared to believe that it played no part in the support of the metacarpals.

Of the distal row of carpals it is only possible to say that they are not yet recognised in either specimen. Whether they have fused with the metacarpals, as they do in modern birds, or were cartilaginous and so not preserved, or were fused with the bones I have referred to as belonging to the proximal row; or whether the two figured by Owen and Dames are the proximal row, and the large bone I have called "ulnare" is really, as the London specimen suggests, a fused mass representing the whole distal row of carpals, can only be decided, so far as I can see, by one of two consummations "devoutly to be wished"—(1) the excavation of the exceedingly thin and fragile Berlin slab *from the back*, or (2) the discovery of fresh specimens. The first of these involves too great a risk to what it is hardly an exaggeration to say is the most valuable palæontological specimen in any museum in the world.

To admit that one does not know what that bone is, is one thing; to ignore its existence is another. Whether it be right or wrong, I shall for the present call it the *ulnare*. Subsequent proof that it is something else, *e.g.*, a crocodilian "lenticulare," will not invalidate my argument.

The **hand** has been so much misrepresented both in words and in drawings that I took it as an "awful example" in my contention as to the sources of error. There are **five digits** and no fewer, and I never suspected that it would be necessary for me to give further proof than that already given in my essay on errors. Great as I represented the power of a "dominant idea" to be, its power over the minds of some persons, to whom I will refer in the sequel, appears to be vastly greater even than I had guessed. To anyone who has understood the evidence already brought forward and whose knowledge of mechanical principles is sufficient to enable him to assess its value, what I have already adduced constitutes a demonstrative proof. I will venture now to prove it over again by three distinct proofs, each of which is in itself conclusive.

(1.) Three *long*, *slender* fingers on each hand are plainly seen on the Berlin slab. They are made up of two, three, and four phalanges respectively, in addition to a metacarpal each. Each bears a claw, which, though not easily made out in the photographs, especially in the smaller photographs, is perfectly distinct in most cases in the slab itself. There can be no doubt, and nobody does doubt, that these three correspond to the digits I, II, and III respectively of the normal pentadactyle reptilian fore-limb. The lengths of the various metacarpals and phalanges in the Berlin specimen are as follows, beginning at the proximal end, *i.e.*, with the metacarpal, in each case:—

I. $8+20+11=39$ mm.

II. $27{\cdot}5+15+19+13=74{\cdot}5$ mm.

III. $26+5{\cdot}5+4+?+?=44{\cdot}5$ mm. The joint between the third and the ungual phalanx is hidden, but these two together measure 19 mm. Of these bones the second metacarpal is the largest, and at its basal end it is under 4 mm. thick.

Some of the bones corresponding to these are to be seen in the London specimen; but as they are displaced, it is not possible to identify them with certainty. What Owen called the two terminal phalanges of the digit I, closely resemble the two terminal phalanges of digit II of the Berlin specimen, and I take them for these phalanges. They measure respectively 22 mm. and 15 mm., *i.e.*, they exceed the bones of the Berlin specimen in the proportion of rather over 9 to 8. To justify this determination I give the lengths of some other bones in the specimens. The first number in each case is the length of the bone in the Berlin specimen; the second, that in the London specimen. Ulna, 56 mm., 63·5 mm.; Radius, 55 mm., 62 mm.; Femur, 51 mm., 58 mm. (?); Tibia, 71 mm., 81 mm. In each case except that of the femur the ratio is almost exactly 8 : 9, and in the case of the

femur it is impossible to measure the exact length in the Berlin specimen. The numbers of vertebræ in the tails differ in the two specimens, so that it will not be safe to take the ratio in length of the two tails as a guide. There is no other bone which can be identified and measured with certainty in both specimens, so we may adopt 8 : 9 as the relative sizes of the Berlin and the London specimens respectively.

But in thickness a different relation holds. In corresponding bones of two similar animals we find that the ratio of thickness to length is always greater in the larger animal. And this is true here: all bones of the London specimen are stouter and more massive than those of the Berlin specimen. Now, in the London specimen two conspicuous bones (badly shown at *cr.* in Fig. 2) were identified by Owen as the "third" and "fourth" metacarpals. They measure 39 and 33·5 mm. respectively in length. In thickness they are much greater than any hand-bone of the Berlin specimen. Others have regarded these bones as the second and third metacarpals. Suppose this were the case, then we get these ratios between the London and Berlin specimens. 39 : 27·5 = more than 11 : 8 and 33·5 : 26 which is 10·3 : 8. Further, the bones are utterly unlike their supposed equivalents in the Berlin slab. They are far stouter, and the longer of the two is exceedingly broad at the base, and therein is well-fitted to resist torsional stress or twist at the joint. In their proximal halves, instead of being slender and almost circular in section, they are stout and have ridges which, when the two were fitted together, would have prevented their movement one on the other. Whatever they are, they are utterly unlike any bones visible in the Berlin specimen. Their position with reference to the feathers of the wing, in spite of the dislocation of other bones, is just that of the large metacarpals in an ordinary bird's wing; and the fact that these feathers are still in their normal position in this wing (the left) justifies the belief that when the animal finally settled down previous to fossilisation those feathers were still bound to those metacarpals by ligament.

This is proof no. 1 that those two bones are the metacarpals of the digits IV and V.

(2.) The second proof is a more formidable one. Some hundreds of experiments extending over hundreds and even thousands of years have shown the effect of "selection" upon dogs, horses, sheep, pigs, pigeons, poultry, vines, roses, plums, apples, pears, strawberries, gooseberries, blackberries, pansies, daisies, dahlias, chrysanthemums, etc., etc., and the result is the same in all cases. Selection occurs in Nature (Naudin, Darwin, Wallace), and its effect is the same as in the case of artificial selection (Naudin, Darwin, Wallace, Bates, and others). I do not think it necessary to repeat the proof of this statement here: the proof is far too long, too well known, and too widely accepted for me to need to say more about it. If anybody should challenge me to do so, I will give a proof of it in a future

article. In the meantime, we may take it as proved that the form and dimensions and structure of every bone and feather in *Archæopteryx* is the outcome of long-continued Natural Selection. The form and structure of the bones of the three digits visible in the Berlin specimen, and of the feathers in the same specimen, show what the conditions of selection have been, and what have been the uses of those several parts.

The digits I, II, and III are long, *slender*, and clawed. Each metacarpal and phalanx is concave on the flexor surface. The ends of the bones are curved like pulleys, allowing of free movement at every joint. A distinct tubercle, for the insertion of the flexor tendon, is recognisable at the proximal end of almost every one of the eighteen phalanges, and these, together with the curvature of the bones, show that flexor muscles were well developed and active and useful, and, in view of the forms of the joints, were useful in producing extensive flexion of those digits. One of these joints has been referred to by some who had not seen the specimen as possibly a fracture (the joint between the second and first phalanges of the third digit, marked 16 in Plate I.,); but a more perfect joint does not exist in the toe of any existing bird than that joint. It is perfectly preserved, and nobody who has seen it can doubt for a moment that it has been evolved under the influence of Natural Selection, and was exceedingly well-adapted to allow of a very extensive flexion.

The feathers are as perfectly adapted to resisting the passage of air through them as in any modern bird. Those who have studied the mechanism of flight in detail will recognise why those feathers are all so curved that the dorsal surface of the wing when at rest is *convex*; why the anterior division of each vane is narrower than the posterior one, and is strongly curved and overlaps the posterior division of the vane of the next feather in front. They will know that such a wing is useful only if adequately supported by rigid bones capable of resisting very considerable torsional stress.

These two sets of structures—the digits I, II, and III, and the feathers—have been evolved under the direction of Natural Selection. They are both, therefore, fitted to perform the functions they actually did perform. The digits were useful for some purpose involving extensive flexion: they were, in fact, used to grasp parts of trees—for I shall show later that the animal did not habitually walk on the ground on all fours. They could not do this if those large feathers were attached to them. Mr. Pycraft has shown that in *Opisthocomus* the young use the digits for climbing, and that in order to enable them to do so the development of the mid-digital and ad-digital quills is delayed till such time as the young are able to fly or to climb without the help of these digits. I thank him for this excellent illustration (NAT. SCI., vol. v., pp. 355 and 358). It confirms the opinion I have expressed that flexible digits cannot be used for climbing if they bear large quills.

And again, the digits I, II, III of *Archæopteryx* (which the large size and perfectly ossified bones show to be an adult, as also do the well-developed feathers) are, by virtue of their very great slenderness and narrowness at the joints, incapable of resisting a great torsional stress. Unless those feathers exert a great torsional stress on the bones supporting them they are useless. I have shown they were not useless. Therefore they exerted a great torsional stress, and therefore they were supported by bones not yet seen in the Berlin specimen, although those of the left wing are seen in the London specimen. It follows, therefore, that the first three digits were used for climbing, and that one or more others were present to support the feathers. That *two* were needed I hope to prove in another place. It would unduly increase the bulk of the present article to prove it here. It is unnecessary, in view of the fact that anybody may see the two metacarpals for himself in the Museum in Cromwell Road.

(3.) The third proof is incomplete. It shows only that the digits I, II, and III did not support the feathers, and that, therefore, something else must have existed to do so. Its simplicity is unsurpassed. It will appeal even to those who ignore both the principles of mechanics and the action of Natural Selection. The figure 10 is placed on the surface of the right wing in Plate I. In this region the dorsal surface of the wing is convex. A rule or "straight-edge" placed on the wing across this point, parallel to the ulna and resting upon the first and second digits, touches the wing along the whole of its length from number 10 backwards. In front of this the feather-surface curves downwards, so as to be perhaps 2 mm. below the edge of the rule near the digits. The *lower* surface of the metacarpal and of the first and second phalanges of the *second* digit lies fully 1 mm. above that feather-clad surface. The bones of the *third* digit are closely pressed down upon, but not sunk below, that surface. Therefore those digits did not lie *in* but *upon* the feathered wing when that animal finally sank dead upon the mud in which it has been preserved. Therefore, further, other bones (or bone) were present to support those feathers. No argument from the embryology of *Opisthocomus* or anything else will shake that conclusion. Whatever argument be urged in future against this view, all that can be shown thereby is the fallacy of the reasoning—but I will return to this in the sequel.

I must here correct an error made in my previous article. The supposed "shadow" (see 12 on the plate accompanying this article) which I referred to is *not a shadow at all, but a yellow stain on the slab.*

The **pelvis** is seen in the London specimen only, and in this specimen nothing is to be learnt from the left innominate, while even the right one is imperfect (Fig. 2, *a*). This innominate appears to have been about 50 mm. long. The acetabulum is perforate. I believe there is no anti-trochanter, though in absence of the specimen I would not make the statement definite. It is a characteristically avian pelvis so far as concerns the length of the ilium and its prolongation to about

an equal extent behind and in front of the acetabulum. If I mistake not, it is conspicuously unlike the pelvis of any existing bird in the matter of width, and the bearing of this will be shown in the sequel.

The **femur**, more slender than in existing birds of the same size, is strongly curved, the flexor surface being concave.

The **tibia** (or tibio-fibula ?) is almost perfectly straight, and has only a small cnemial crest.

The **foot** is a characteristically avian foot. In the Berlin specimen the matrix around the feet is so hard that a complete exposure of them has proved impracticable. The London specimen shows the left foot well. It is more massive and in every way larger than the corresponding parts of the Berlin specimen.

C. HERBERT HURST.

(*To be continued.*)

EXPLANATION OF PLATE I.

A photograph of the Berlin specimen of *Archæopteryx* taken before the skull and certain other parts were as fully exposed as they now are. (Scale 5 : 17.)

1. First digit of left manus. 2. Second ditto. 3. Third ditto. 4. Radiale of left carpus. 5, 6, 7. First, second, and third digits of right manus. 8. Region of right wing which in the specimen lies lower than the visible bones of the hand and lower than the region marked 10. 9. Primary quills of right wing. 11. Small portion of matrix lying upon proximal end of humerus. (See reference to this in the text.) 12. Yellow stain resembling, in the photograph, a shadow. 13. Cnemial crest. 14. "Abdominal" or ventral ribs. 15. Feathers of crural aëroplane. 16. Joint between second and first phalanges of third digit. 17. Left femur.

The specimen was illuminated at the time of photographing by light falling upon it from above and in front and slightly to the left.

ARCHÆOPTERYX.

V.

Earthworms and Oceanic Islands.

IT is impossible in the present state of our knowledge to write anything like an exhaustive article with the above heading; but we are in possession of a certain number of facts which have never, so far as I am aware, been put together in a connected form. It may be of some little interest to do this, as the group of earthworms is one which is in many ways the most suitable for use in attacking the problems of geographical distribution. It will be convenient, perhaps, to commence with an enumeration of the bare facts *seriatim*, and to follow this with a general comparison of them. We shall, therefore, take those truly oceanic islands from which earthworms have been brought one by one.

The Bermudas. *Onychochæta windlei*, Pontodrilus bermudensis, Perichæta bermudensis.

Teneriffe. Microscolex modestus, Allurus tetraëdrus.

The Azores. Allobophora eiseni, A. nordenskioldi, A. trapezoides, A. chlorotica, A. putris, Perichæta indica.

St. Helena. Eudrilus eugeniæ, (Lumbricus helenæ, L. josephinæ, L. hortensiæ, Perichæta sanctæ-helenæ).

Madeira. (Lumbricus vineti.)

Fernando Noronha. Pontoscolex corethrurus.

South Georgia. *Acanthodrilus georgianus.*

Marion Island. *Acanthodrilus kerguelarum.*

Kerguelen. *Acanthodrilus kerguelarum.*

Mauritius. *P. mauritiana, Perichæta robusta*, (P. mauritii).

Rodriguez. (Perichæta rodericensis.)

Seychelles. Megascolex armatus.

Marquesas. *Megascolex albidus.*

Upolu. *Perichæta upoluensis.*

Tahiti. *Perichæta grubei, P. novaræ*, (Lumbricus tahitanus, Pheretima montana).

Pelew. Fletcherodrilus unicus.

Fiji. *Dichogaster damonis, Perichæta vitiensis*, (P. subquadrangularis).

Hawaii. *Perichæta hawayana, Pontoscolex hawaiensis*, (P. corticis, Hypogæon havaicus). Limnodrilus sp.

Tonga. (Lumbricus tongaënsis.)

It should be mentioned that in the above list those species which are peculiar to the islands in question are marked in italics, those which are found elsewhere, as well as in those islands, in roman character, while species *incertæ sedis* are enclosed in brackets.

The list is unfortunately by no means imposing, but it sums up the facts at our disposal. I have, of course, not considered New Caledonia as belonging to the category of oceanic islands; and there are some who will find fault with me for placing Mauritius and the Seychelles in this list at all. Otherwise, I think that all the islands which I include are true oceanic islands of either volcanic or coral origin, which have never formed part of a pre-existing continent. It is unfortunate, too, that so large a proportion of the species are *incertæ sedis*; most of these were described by Kinberg in the *Öfversigt* of the Swedish Academy for 1866, at a time when the structure of this group of animals was very little known; his "Lumbricus" is far from being coëxtensive with that genus as at present understood.

The facts, so far as they enable any generalisations to be formed, seem to indicate that earthworms are among those groups which have the greatest difficulty in crossing the sea by the usual means of transit open to such creatures. Very few exact experiments have been made; but what we do know appears to indicate that salt water is fatal to them. This statement cannot be made universally. There are a few—very few—species which habitually live upon the sea shore; this is the case with *Pontodrilus litoralis* of the Mediterranean coast, and of the allied species *P. bermudensis* of the Bermudas, Brazil, and Jamaica. Schmarda described, under the name of *Pontoscolex arenicola*, at least three species from the shores of Jamaica, of which one is the same as that subsequently described by Perrier as *Urochæta hystrix*, a very widely distributed form; *Pontodrilus bermudensis* was also confused under the same specific name, as also was a third species which I have called *Pontoscolex arenicola*, preserving Schmarda's original name. It has been also asserted that certain Ceylonese earthworms are not killed by sea water. It will be observed, however, that the facts contained in the list which I here give argue strongly that it is only exceptionally that earthworms can have crossed the sea to oceanic islands by the help of trees floating along with currents, the only natural method that suggests itself.

In remote oceanic islands, such as the Azores, the species are all widely-distributed forms. *Perichæta indica*, for example, is one of the commonest species to be met with in gatherings of earthworms from foreign parts, and it has also been found in greenhouses in this country and in North America. This fact seems to show some special adaptation on its part for accidental exportation by man. Precisely the same remarks may be made concerning *Pontoscolex corethrurus* and *Eudrilus eugeniæ*. The former species is almost the most widely-distributed earthworm known. Specimens have been recorded from various parts of South America, from the Malay

Peninsula, from Ceylon, and from Australia. One is disposed to argue from its prevalence that it has been accidentally carried about with plants, etc.; there is no doubt that in these various localities it is one of the commonest species, hence the chances of its accidental transference are large. *Eudrilus eugeniæ* has a similarly wide range. It occurs in South America, Ceylon, New Zealand, New Caledonia, etc. Now it will be noted that both these species occur upon true oceanic islands. The semi-marine habit of *Pontoscolex* has been already referred to. This may be considered in relation to the occurrence in Hawaii of a species which really appears to be different from *P. corethrurus*, and also to the existence in the Bermudas of *Onychochæta windlei*, a form which I separate generically, but which Dr. Rosa does not. Here we have apparently two forms which are peculiar to the islands in which they are found; it may be that they have been introduced in the past by some natural means and not by man's interference. It is probable, however, that the two species which occur in Teneriffe are accidental importations; they are both species of wide distribution. *Microscolex modestus* is found in such widely-separated places as Italy and the Argentine. *Allurus tetraëdrus* inhabits Europe and New Zealand.

The facts that are known respecting the earthworm fauna of the islands in the Antarctic area have a greater significance, for, from the present point of view, this region of the world is better known than many others. Here we have a state of affairs which is quite typical of oceanic islands: they are inhabited, that is to say, by species different from but allied to those of the nearest mainland. *Acanthodrilus georgianus* of South Georgia is so near to *Acanthodrilus falclandicus* of the Falkland Islands that I at first confounded the species; they were, however, rightly, as I am now convinced, distinguished by Michaelsen. The small *Acanthodrilus* of Marion Island and of Kerguelen (they appear to be the same so far as my recollection of the characters of the former goes) are near to South American forms. This genus is the prevalent genus of the Antarctic region, being found abundantly in New Zealand as well as Patagonia and Chili, and occurring also, though more sparsely, at the Cape of Good Hope and in Western Australia and New Caledonia. It must be further borne in mind in considering the range of the present genus that it can live in water with greater ease than some species, and that one form at any rate, *Acanthodrilus litoralis* of Kinberg, was discovered by him "Insula freti Magalaënsis juxta litus."

F. E. Beddard.

SOME NEW BOOKS.

Trematodes from Japan.

Studies upon the Ectoparasitic Trematodes of Japan. By Seitaro Goto. Pp. 270, with 27 plates. Vol. VIII., Part I., of *The Journal of the College of Science*, Imperial University, Japan. Tokyo, 1894.

We have received from the Imperial University this beautiful memoir, written in English, but concerning work done in Japan, and printed, illustrated, and published in Japan. At the present time the Press of Europe seems to be making up its mind whether or no Japan is to be admitted into the comity of civilised nations. For our own part, we make no nice distinctions in the matter of warfare, holding it all a necessary abomination, and regarding the details as equally savage and degrading whether they be wrought out according to "rules of the game" at Waterloo or against the rules of the game as at Culloden, and, apparently, at Port Arthur. But while the Press disputes, Japan has quietly taken her place. The most casual perusal of the memoir now before us shows that Paris, London, or Berlin might have been proud to issue it.

Thirty new species are described, belonging to the genera *Microcotyle*, *Axine*, *Octocotyle*, *Diclidophora*, *Hexacotyle*, *Onchocotyle*, *Calicotyle*, *Monocotyle*, *Epibdella*, and *Tristomum*. But most readers will be more interested in the anatomical work.

Mr. Goto found that familiar methods of preparation gave the best results. The animals were killed with hot saturated solution of corrosive sublimate, preserved in seventy per cent. alcohol and stained with Kleinenberg's hæmatoxylin. For mounting whole, specimens were killed under the pressure of a cover-slip over the flame of an alcohol lamp, then preserved in seventy per cent. spirit and stained with borax carmine, the excess being washed out with acidulated spirit. By this method "only the internal organs and the nuclei of the mesenchyma remain stained, while the mesenchyma itself is wholly decolourised, so that the result forms altogether a very beautiful object under the microscope."

Among the many anatomical points that will interest specialists, the structure of the mesenchyma will interest all anatomists. This tissue, at least in the Digenea, consists of large vacuolated cells, between which a fibrous network with small nuclei is present. It varies from a truly cellular character to a typical reticulated fibrous connective tissue on the one hand and a true syncytium on the other. It is usually divided by a thin membrane of compact connective tissue into an ectoparenchyma, in which run the diagonal and circular muscular fibres, and an inner more vacuolated endoparenchyma in which the outlines of the cells tend to become obscure. Let those who still hold that there is no such morphological structure as a mesenchyma to be distinguished from a mesoblast note these conditions.

Mr. Goto holds that the term "intracellular" has been applied

wrongly to the excretory system of Trematodes and Turbellaria, and that it is phylogenetically of the same order as that of the Nemertines and the flat-worms, thus confirming the opinion of Whitman upon this point.

One of his main arguments for this view is drawn from the presence of cilia within the tubes. We have, as he points out, no reason for supposing that cilia, which are characteristic structures of the outside of cells, ever grow upon the inner sides of the cell-wall.

At the end of the anatomical part of the paper some interesting biological notes are given. Most of the ectoparasitic Trematodes live attached to the gills of fishes; but some live in the mouth-cavity or on the general surface of the body. When two species are found living on the same fish, generally they confine themselves to separate regions. Thus *Tristomum sinuatum* and *T. ovale* live upon a *Histiophorus*, but the latter confine themselves to the mouth-cavity, the former to the inner surface of the branchial plates.

When removed from the host and placed in water many of the Trematodes move about by looping movement, using their suckers like those of the leech. Most of them live upon the slime of their host, but a few are able to extract blood.

Most of the monogenetic Trematodes have a colourless and transparent body in which the vitellarium and the pigment cells of the intestine are the only coloured parts. However, says Mr. Goto, "This must not be regarded as a case of protective colouration; for, in the first place, the nature of the habitat already protects the parasites from being attacked by their enemies, and in the second place, they are but very imperfectly exposed to light and thus the conditions of their existence prevent any effective play of Natural Selection."

A History of the World.

DIE VORWELT UND IHRE ENTWICKELUNGSGESCHICHTE. Von Dr. Ernst Koken, Professor an der Universität Königsberg. 8vo. Pp. viii., 655, with two folding maps and 117 text figures. Leipzig: T. O. Weigel Nachfolger. 1893. Price 14s.

THE change that has taken place in the position of geology since the early years of this century nowhere makes itself more felt than in a book such as the present. In former days a Humboldt or a Lyell could appeal with safety to a larger public: vistas were then being opened that stirred the imagination of all; the broad lines of the drama arrested the attention; and details gave no trouble, because details were still unknown. Nowadays we know so much, and we have pushed out into the darkness in so many directions, that a comprehensive survey is a task of far greater difficulty: we are overwhelmed by the extent and by the specialisation of our information; it is the details that interrupt our vision, and "we cannot see the wood for the trees." In these respects, too, the geologist, whose science is a compound of so many other highly-specialised sciences, of physics, of chemistry, of zoology, and the like,—the geologist or the historian of the whole earth stands at a great disadvantage as compared with the historian of but a small portion, or of a small and unremote period. The archæologist and the man in the street soon find a common platform and a common speech, but the geologist of to-day no longer tells his story in the vulgar tongue. These difficulties have been fully understood by Dr. Koken, and his book, written for the most part in a flowing and distinguished German, is an excellent attempt to overcome them. He will not, however, spare his readers

all brain-work; he has had to read and toil much to put these things before them; they, for their part, must take some pains to understand him. As he truly says, "A popular superficiality is of service to no one, and by it our science is only injured."

The work is divided into fourteen chapters, of which the first three deal with such general questions as the interior of the earth and the origin of igneous rocks, the upheaval and erosion of the land, and the biological, physical, and astronomical methods of estimating the duration of geological time. Then follow ten chapters which describe the gradual evolution of the world from Cambrian times to the close of the Glacial Period, each chapter dealing with a geological system, describing its living beings and the distribution of its lands and seas so far as knowledge permits. Either the first appearance or the acme of any important forms of life introduces a fuller explanatory description of the group to which they belong. The final chapter sums up the general results from the point of view of changes of climate and geography and the evolution of organic life.

As an example of Dr. Koken's method, let us see how he treats the Silurian System.

This term is used in its older and broader sense for all strata between Cambrian and Devonian. For Europe, the *Dictyonema* Shales are regarded as passage-beds from Cambrian to Silurian, but it is pointed out that the precise boundary might well be drawn at many another level. Broadly speaking, the beginning of the Silurian is marked by increase of trilobites, and the sudden appearance of thick-shelled cephalopods and gastropods. A corresponding lithological change is the development of limestones instead of the sandstones and clays of the Cambrian. This again was connected with a general sinking of the land and extension of the sea in the most characteristic Silurian areas. The enormous thickness ascribed to the passage-beds in N. America gives Dr. Koken "the impression that the American geologists are not yet masters of the faunistic and stratigraphic difficulties." Similar passage-beds are found in China, in Australia, and perhaps also in Argentina.

This account is appropriately followed by a short description of *Dictyonema*, and a comparison of it with other graptolites. The trilobites, already described in the Cambrian chapter, have their chief forms alluded to. An interesting attempt to reconstruct the physical geography of the period leads on to an account of the typical Silurian and its distribution.

The lower beds of the Silurian closely follow those of the Upper Cambrian in their distribution, but in many places overstep the limits of the Cambrian sea. In Upper Silurian times the mainlands were again more elevated, but occasional transgressions of the sea in areas where Lower Silurian is unknown show that there were independent movements of the earth's crust. The close of the system is here and there marked by beds which could only have been deposited in parts of the sea that were passing away, partly brackish, partly very salt from evaporation. While communication between the northern parts of Europe and America remained free, a very distinct marine province ran from Belgium over France and Germany to Bohemia and the Eastern Alps, and also included the Silurian of Spain and Sardinia and such sporadic portions as are known in the Mediterranean. In this peculiar basin the fauna was totally disconnected from that of the preceding Cambrian sea. It is possible that this Silurian Mediterranean extended eastwards into Indian and possibly Chinese waters.

The Russian Silurian, with its regular structure, is taken as a type, and described in detail. A few comparisons are made with that of Sweden; but Englishmen, at least, will find it odd to have the land of Murchison passed over with the merest mention. Neither here, however, nor elsewhere does Dr. Koken confuse that which has been important in the human history of discovery with that which has a more abiding importance in the scheme of world-history.

The Silurian strata of the rest of the earth are briefly discussed. It is held that many North American species are identical with those of Northern Europe. It is thought probable that S. America was then joined to Africa and that no S. Atlantic then existed; but the evidence for this is obviously negative.

Forty-four pages are then devoted to an account of the Silurian fauna, an account both broad in view and remarkably readable. The arachnid affinities of the Eurypterida are somewhat scoffed at, while Simroth's view that the ancestors of these and of *Limulus* were evolved on dry land finds scant favour in Dr. Koken's eyes. The presence of true cirripedes argues a long previous history of the Crustacea in the sea. Considerable space is devoted to the cephalopods, and worthily so, although many may think that the hypothetical Microsiphonulas, Cæcophoras, etc., of Hyatt are a little over-prominent. Dr. Koken is so well known as an earnest student of the gastropods that his account of their Silurian representatives will be read with interest by every palæontologist. The bivalve shells of the period meet with a like capable treatment. Neither here nor in other chapters is so much attention devoted to the crinoids as their numbers and beauty might warrant; there are, however, some suggestive remarks on the cystids. The corals and graptolites, too, are rather crowded out, and we could imagine a more satisfactory treatment of the fish. Considerable attention is paid to the arthropods of the land, and especially to the researches of S. H. Scudder and Erich Haase.

Space precludes our dealing with the interesting final chapter, in which the author points the moral of his tale, and takes his stand on a firm Uniformitarian basis. We could wish to translate the whole of this suggestive summary, but instead we can only recommend all serious students to peruse the book for themselves.

A word of praise is due to the illustrations, many of which are new and, like the text they adorn, well up to date. Could an English translator and publisher be found, the book would make an admirable complement to Professor Bonney's "Story of our Planet" (*see* NATURAL SCIENCE, vol. iv., p. 62). Till then we congratulate readers of German, no less than Dr. Koken and his Leipzig publisher.

F. A. B.

IN THE FORESTS OF GUIANA.

IN THE GUIANA FOREST: STUDIES OF NATURE IN RELATION TO THE STRUGGLE FOR LIFE. By James Rodway, F.L.S., with an introduction by Grant Allen. Pp. xxiii. and 242, with 16 plates. London: T. Fisher Unwin. Price 7s. 6d.

IN reminding Mr. Fisher Unwin of the old proverb that "Good wine needs no bush," we do not mean to cast any slur upon Mr. Grant Allen's preface, which is, as are indeed all his essays, crisp and interesting. Mr. Rodway, however, though it may be that he is less known to the public than many writers with half his abilities, can stand upright without any adventitious props whatsoever. In this volume we are presented with a series of essays upon tropical life as

seen in British Guiana, which are partly reprints of papers contributed to this Journal among others. To the present writer, whose sympathies are rather zoological than botanical, the volume appears to be almost too much devoted to plant life; but there is one highly interesting essay upon animal life and another upon "The Man of the Forest," with which we shall chiefly deal in this review; not because they are markedly better than the others, but merely on account of the regrettable fact that the editor's definition of space differs from that of the astronomer.

Mr. Rodway points out that, while elsewhere there is a continual shifting of balance in the organic world, the Indian of the Guiana forest is "in almost perfect harmony with his surroundings." Nor is he to be defined at all after the fashion of Artemus Ward. "One of nature's gentlemen" is among the many complimentary descriptions given of him by Mr. Rodway. The Indian father and mother perform their duties by their offspring in a way which might advantageously be copied by many examples of the so-called civilised man. While the child is young, the father allows himself no free exercise of his natural love for hunting and fishing; he restricts himself to what is the bare necessity, for fear of wearying the "child-spirit" which is believed to be always with him. An education of the kind needed by the young "savage" is most carefully given, and we learn that even infants of a tender age "take life seriously" like their parents; the romping incidental to Aryan childhood is almost unknown to the offspring of the dwellers in Guiana forests. Nevertheless, they have their games, which from their utility should win the approbation of the unintelligent middle classes of this country, who favour a "commercial education." They learn to hunt and to shoot and play games in which excellence in pursuing imaginary prey wins the day. The blow-pipe is, of course, one of the principal implements of sport; we have been told by a friend, who knows the country described by Mr. Rodway, that an experienced Indian will use as many different kinds of blow-pipe as a golfer will clubs. The mystery which is attached to the names of the people is remarkable; a child is given a name, but it is never called by it. It is termed "boy," or "girl," or "friend," or some such general term. Its immediate relatives may be presumed to know what its "Christian" name is, but they cannot be induced to reveal it. The easiest way to annoy this peaceful and kindly race is to be pertinacious in indiscreet enquiries about the names of individuals. Mr. Rodway suspects that the names are those of animals, and that the people have a superstition that to know the name is to have some malign influence over its owner. There appears to be but little "poll-parroting," as Mr. Riderhood would have said, among the ladies of the Guiana communities. Conversation among all classes has a distinctly sporting flavour, and deals with the exploits of the talkers. As the women have naturally but little experience in this way, and as their dress is limited to an apron of beads subject to no fluctuation of fashion, conversation on their part is not discursive. The race is silent enough to have won the approbation of Carlyle. The Indian makes but little impression upon surrounding nature; he leaves no monuments, and when the white man comes he disappears silently. A "deserted village" in Guiana is even more desolate than that pictured by Goldsmith. Not even a parrot remains to hint of the language of the departed tribe.

It has often been pointed out that the forests of tropical America, instead of teeming with visible life, as is the opinion of many of us at

home, are apparently almost as void of living creatures as the great depths of the ocean were once supposed to be. The collections of gaudy butterflies and brilliantly painted birds which we see in museums give an idea of wealth and beauty in the manifestations of life which is far from being the truth. "To the stranger," remarks Mr. Rodway, "the forest appears almost deserted. Hardly the sign of an animal is to be seen by any but a skilled huntsman, and by him only after a most careful search." To the new-comer the forest suggests rather an African desert than a home of abundant animal life. Even to the dullest observer, however, the sandflies and ants are plainly sensible; so too is the moist and steamy atmosphere of this tract of the world, which Mr. Sclater so aptly termed "Dendrogæa." Apart from these insects, it is sounds rather than sights which obtrude themselves upon the wanderer. "The red howling monkey, hidden in the foliage overhead, keeps up his reverberating notes at intervals for hours, and makes the stranger exclaim almost in a fright, 'Whatever can that be?' Then come the tree-frogs which astonish us with their loud whistling or booming, while the buzzing of the cicada or razor-grinder is even more startling."

To Mr. Rodway, however, the forest is all alive, and he gives a most real picture of what he has seen in a fashion which has been but little done for this part of the world, and never done precisely in the author's way. Mr. Grant Allen calls him the "Jeffries of the Tropics." He is not, however, troubled, like the late Richard Jeffries, the "Son of the Marshes," and others of the present numerous race of "scientifico-literary" writers, with the deeply uninteresting yokel and gamekeeper, who taint the freshness of the descriptions with dull remarks phonetically transliterated.

F. E. B.

Spelæology.

Les Abîmes, les Eaux Souterraines, les Cavernes, les Sources, la Spélæologie. Explorations souterraines effectuées de 1888 à 1893 en France, Belgique, Autriche et Grèce avec le concours de MM. G. Gaupillat, N. A. Sidéridès, W. Putick, E. Rupin, Ph. Lalande, R. Pons, L. de Launay, F. Mazauric, P. Arnal, J. Bourguet, etc. By E. A. Martel. 8vo (12½ by 9 inches). Pp. 580, 320 maps, sections, photogravures, and other illustrations, Paris: Delagrave, 1894. Price 20 frs.

This is an exceedingly interesting book and a valuable addition to our knowledge of caverns and underground watercourses. The volume opens with a chapter on cave-hunting, treating of methods of exploration, classification of subterranean excavations, tools required in working, explosives, dangers to be encountered, photography, etc. The author-editor then proceeds to describe in detail the caverns of the districts of Vaucluse, Ardêche, Le Gard, L'Hérault, Larzac, Bramabiau, Causse Noir, Dourbie, Jonte, Causse Méjean, Florac and Rodez, Tindoul de la Vayssière, Causse de Villefranche, Causse de Gramat, Badirac, Causse de Martel, Miremont, La Dordogne, Puy de Dome, Dourgogne, the Seine basin, and others in France. Then follow three chapters on the caverns of Belgium, Austria, and Greece, and the work concludes with observations on caves in general, springs and underground rivers, theories of the formation of such phenomena, and general notes on objects found in caverns, and their bearings and interests.

The volume is profusely illustrated with valuable and interesting pictures, mostly reproductions of photographs, some of which form full-page plates done by heliogravure; carefully executed ground-

plans and sections are given of each cave, most of which are drawn by the author or his companions, and of these plans we may call especial attention to that of the Trou de Grandville in the Dordogne, and that of the subterranean river of Bramabiau (Gard). This latter plan is simply a revelation to the geologist, as about half a square kilometre of the district is a perfect network of tunnels, in which the Bramabiau and Le Bonheur rivers disappear. These plans bring home to the reader the amount of denudation slowly going on from the percolation of water, and the possibilities of minor alterations to the surface features in limestone districts.

We cannot recall any book on the subject which has been so carefully compiled and so beautifully illustrated, and the moderate price of the volume should permit of a large and well-deserved sale.

We learn that this and the other writings of Mr. Martel have aroused such interest in subterranean investigation, that he has succeeded in founding a society, named "La Société de Spélæologie." Those interested should communicate with Mr. Martel, at no. 8 Rue Menars, Paris.

As this notice was going through the press, we saw a second book on the same subject, relating mainly to Austrian caverns. "Höhlenkunde" as the book is called, is written by Franz Kraus, and published by Gerold's Sohn, of Vienna. It has 155 illustrations, and a map showing the Bavarian caves, contributed by Dr. W. Gümbel; but while equally useful, it is by no means so beautifully produced as "Les Abîmes." The price is 10 marks.

THE PERMIAN FISHES OF BOHEMIA.

FAUNA DER GASKOHLE UND DER KALKSTEINE DER PERMFORMATION BÖHMENS. By Anton Fritsch. Vol. iii., part 3. Pp. 81-104, pls. 113-122. Prague: F. Rivnac, 1894.

THE higher fishes of the Palæozoic Epoch are difficult to understand, and further progress in elucidating their relationships can only be made by a detailed study of their osteology such as is now being undertaken by Dr. Anton Fritsch in Bohemia. When reviewing last year's instalment of the Professor's work (NATURAL SCIENCE, vol. ii., p. 435), we alluded to the opinion that these fishes, commonly grouped in the family Palæoniscidæ, are the scaly and normal forerunners of the scaleless and abnormal modern sturgeons. All the facts hitherto published appear to justify such a view; and we thus turn with interest to the new part of the "Fauna der Gaskohle" which now lies before us. In the present instalment, Dr. Fritsch describes two more Palæoniscids with delicate scales, and some species related to *Amblypterus*, while his detailed letterpress, as usual, is illustrated with numerous diagrams and some coloured plates.

The fishes with thin scales which Dr. Fritsch terms *Sceletophorus biserialis*, and the scaleless which he assigns to the genus *Phanerosteon*, are of most interest because they display a few traces of the internal skeleton of the trunk. We observe no remarkably new facts, however, because we consider the author to be entirely mistaken in his determination of the presence of calcified vertebræ. In our opinion the structures described by Dr. Fritsch as such are merely crushed portions of the appended arches. We do not perceive even isolated hypocentra and pleurocentra, and we must thus continue to believe that the Palæoniscidæ are as destitute of rudiments of vertebræ as the modern sturgeons.

The author's numerous diagrammatic sketches and brief detailed descriptions will be very useful for reference, and we advise all

interested in Ichthyology to peruse this latest contribution to our knowledge of the Permian fauna. A. S. W.

In the Eastern Seas.

Australasia. Vol. ii., Malaysia and the Pacific Archipelagoes. Stanford's Compendium of Geography and Travel (new issue). Edited and greatly extended from Dr. A. R. Wallace's "Australasia" by F. H. H. Guillemard, M.A., M.D. Cantab. 8vo. Pp. xvi., 574, with maps and illustrations. London: Stanford, 1893. Price 15s.

In Natural Science for December, 1893, we had an opportunity of calling attention to volume i. of the present work, a volume by Dr. A. R. Wallace, dealing with Australia, New Zealand, and Tasmania. We have now the second volume dealing with the numerous islands of the Eastern Indian and Pacific Oceans contained between the 100 E. and 100 W. longitudes of Greenwich, and between the 30 N. and 30 S. latitudes.

The enormous area and the number and variety of lands, peoples, and natural history products therein described, make this volume of equal if not of greater interest than the former, despite the fact that volume i. dealt with lands now mainly peopled by our own kith and kin.

Dr. Guillemard has given us a book of singular value, a book not merely useful for reference, but full of the most varied information and live and general interest, one which can be read and re-read with pleasure and profit.

In a general introduction a sketch is given of the definition and nomenclature of Malaysia, Melanesia, Polynesia, and Micronesia, the extent and distribution of lands and islands, geographical and physical features, ocean depths (and these reach 19,866 feet near the Phœnix Islands, and 17,389 feet near Tonga), the races of mankind (of an interest scarcely surpassed in any other quarter of the globe), the zoology and botany, geological relations, and past history.

Passing to the special subject, Dr. Guillemard treats first of the Malay Archipelago, a geographical term which includes the Philippines, Java, Sumatra, Borneo, Celebes, the Moluccas, and the Sunda Islands. Of these, Java, Sumatra, Borneo, and the Celebes have each a separate chapter, while the numerous islands making up the other two groups are treated in the remaining two chapters. Melanesia includes New Guinea, the Fiji Islands, the Solomon Islands, and the groups of Santa Cruz, New Hebrides, New Caledonia, and the Loyalty Islands. Polynesia includes Tonga, Samoa, Union Group, Ellice, Hervey, Society, Austral, Marquesas, Phœnix, Manahiki, America, Sandwich, Gambier, and Easter Islands; while Micronesia includes the Gilbert, Marshall, Caroline, Pelew, and Ladrone Groups.

Returning to Malaysia, we find the greater part of the land area belongs to Holland, the Spaniard rules exclusively in the Philippines, an English rajah rules over a portion of Northern Borneo, a small portion of Timor is the sole remaining fragment of the former extensive dominion of Portugal, and some few islands are still ruled independently by native sultans.

Malaysia is the seat of one of the most extensive and continuous volcanic belts in the world, and this subject receives adequate treatment by Dr. Guillemard considering the space at his disposal. He has also inserted a map showing the distribution of the active and extinct volcanoes, and this is interesting as showing the almost entire absence of volcanoes in the Borneo and Celebes area, one doubtful

volcano only being indicated near the western coast of Borneo, and a few at the extreme north-eastern corner of Celebes, the belt running through Sumatra, Java, Sumbawa, Flores, the Banda Archipelago, the Moluccas, and the Philippines. A sketch of the Malay race and language follows, in which the views of Professor Keane are introduced and general observations on the characteristics of the people given. Speaking of the religions of the Malays, Dr. Guillemard says: "Some of them are Christians, that is to say, they attend the services of the Dutch Church, abstain from shaving their heads or filing their teeth, and drink wine and spirits." It is to be hoped, however, that the Malay Christian has a better reputation than the "Christian" of Africa.

The picture of life in the Philippine Islands is by no means pleasing; after describing the beauty of the scenery, with its mountain ranges and tropical vegetation, the author says, "the populous towns and villages are decimated by frighful epidemics—smallpox and Asiatic cholera, while erratic flights of locusts darkening the heavens like dense clouds, devour the young crops, leaving hunger and famine in their wake. With the changes of the monsoons the swollen streams overflow the land; and when the industrious Tagal fancies he has escaped the devastating floods in his log hut or stone house, he is suddenly buried by an earthquake beneath its ruins, stifled in a burning rain of cinders from some new-born volcano, or hurried to a still swifter death in the overwhelming waters of an earthquake-wave." In a long chapter on the Flora and Fauna of these islands we read that there are 52 peculiar species of ferns, and that the proportion of monocotyledonous to dicotyledonous plants is more than one-half, a peculiar condition in a tropical insular flora. Of animals, only twenty-three terrestrial mammals are known and 303 species of land birds. But as the restrictions to scientific investigation are removed by the Government it is to be hoped that a better knowledge of all groups will shortly be forthcoming. The python in the Philippine Islands is said to reach 40 feet in length. Of the native races, the Negritos and the Malays, Dr. Guillemard has much to say, and an excellent picture of one of the former is given. Blumentrit estimates that there are 20,000 Negritos, and they live chiefly in Luzon, Mindoro, Negros, Panay and Mindanao; of the Malayan stock, the two chief tribes are the Tagal and the Bisayans, the former mustering some 1,500,000 souls, and living in Luzon, Marinduque, and Mindoro, while the Bisayans number 2,000,000 and occupy the islands between Luzon and Mindanao, and some portions of Luzon. There are numerous other races, but we must refer the reader to Dr. Guillemard's volume. After some chapters on the religion, trade, government, population, etc., the author treats the islands composing the group in separate sections, and then passes on to consider the Dutch East Indies.

Taking Java as a starting place, we are reminded that the Dutch did not get a firm hold of the island until 1830, but since then its development has been rapid and successful. A short but excellent account of its volcanoes is given, there being no less than fifty volcanic peaks on the island. The highest of these mountains reaches 12,044 ft., ten exceed 10,000, and ten 9,000, and of the fifty some twenty-five are more or less active. Salak, Galunggung, Guntur, and Papandayang are among the most destructive. The second of these, in five hours, on October 8, 1822, destroyed nearly everything within a radius of 20 miles with a deluge of hot water and mud, while quantities of ejecta fell 40 miles away from the crater. The remarkable antiquities connected with the Hindu religion still remaining

buried in the forests of Java are described, and a picture of the wonderful temple of Boro-Bodor, dating from 1344, is given.

But while Java is "throughout its whole extent brought under the influence of civilisation, and covered with a network of roads and railways, Sumatra still remains, to all intents and purposes, a wild and savage land." The Dutch have been settled there since 1824, and have made slow and steady progress in the acquisition of territory; but much remains to be done to bring the island to the state of government so well seen in Java. An equally interesting account of the volcanoes of Sumatra to that of Java is given, and the story of the grand and terrible eruption of Krakatau is repeated. It is almost impossible to realise the magnitude of this volcanic outburst, even when we are reminded that a mass of land $3\frac{1}{2}$ miles by 2 miles was entirely removed and a sea occupies its place giving soundings of 90 to 164 fathoms. One-half of Krakatau Island disappeared, and Verlaten Island was increased to thrice its original size. The singular phenomena of the waves of water and air are also discussed, and the fact of the explosions having been heard at distances of 2,014 and 2,968 miles is also noted. Borneo and Celebes are treated by Dr. Guillemard in the same careful and systematic way, and scarcely less space is given to the Moluccas and the Sunda group; the whole account of Malaysia occupying 375 pages of the book. Interesting notes are given concerning the edible birds'-nests from North Borneo, from which one gathers that no less than 20,000 pounds' worth are annually sent to Singapore and China. The yield from the Gomanton caves is put down at over £5,000 annually, and a description is given of the difficulties of collection from places often more than 400 feet high, and in absolute darkness except for the candle of the Dyak.

Chapter xi. deals with Melanesia. There is a good account of New Guinea, drawn from the latest publications on the island; much more exploration has to be done, however, before a general knowledge even of this vast territory can be obtained. The geology, zoology, and botany of New Guinea are still very imperfectly known, but the island has already yielded the singular *Proechidna*, some tree kangaroos, and a few peculiar rodents, while no less than 400 species of land-birds have been discovered, including 40 species of birds-of-paradise, and some bower birds allied to *Amblyornis*, which construct "playing or coursing-grounds of so remarkable a nature, that were not the facts attested by well-known naturalists, they would be almost incredible. One builds a raised ring around a small tree, this miniature circus being about two feet in height and provided with a parapet," and another, "also selecting a small tree as the centre of its building, forms around its base a bank of moss, which it decorates by inserting flowers. The ring, or circus, is round this bank, and the whole is protected from the sun or rain by a domed construction which completely covers and surrounds it, except for an entrance at one side."

It would not be fair to the author, or to our own space, to say more of this interesting book, which, with the other volumes of the series, puts geography in so pleasing yet instructive a way. We shall look forward to the volumes on Africa and Asia by Mr. Keane, shortly to appear, with considerable pleasure. The maps are numerous, well done, and all-sufficient for the purposes required, and the illustrations seem to be well selected and are a great addition to the text. To many the countries described in this volume are almost mythical, and these will specially welcome this part of Stanford's Geographical Compendium.

NEW SERIALS.

IN September, 1894, the Para Museum issued no. 1 of the *Boletim do Museu Paraënse de Historia Natural e Ethnographia*. The part contains papers on "Archæology and Ethnography of Brazil," by F. Penna; "Notes on the Spiders of Brazil," by Dr. E. Goeldi; "Notes on some Terrestrial Worms of Brazil," by Dr. Goeldi; and "Observations and Impressions of a Journey from Rio to Para," by the same. A portrait is given of Governor Lauro Sodré, to whose kindly interest the Para Museum has been much indebted.

L'Ami des Sciences Naturelles is the title of a new monthly devoted to zoology, botany, and geology. The new journal is edited by Mr. E. Benderitter, and is published at Rouen.

Dr. Roux is the editor of a new serial devoted to experimental morphology, *Archiv für Entwickelungsmechanik der Organismen*, for which Mr. Engelmann, of Leipzig, is the publisher. The opening paper of the first number gives an interesting account of the methods and objects of this biological study.

The New York *Nation* says that our American contemporary *Science* is to be revived under an editorial committee. Among the names of the committee mentioned are Professors O. C. Marsh, H. P. Bowditch, W. K. Brooks, N. L. Britton, and Drs. Hart Merriam, J. W. Powell, and D. G. Brinton.

The *Footpath* is a new paper that purports to deal with natural history. Having been so fortunate as to obtain a letter by Mr. Gladstone in praise of natural history for the young, it has received some notice from the public Press. We, however, have not as yet been afforded an opportunity of judging as to the merits of its other contents.

Under the direction of the well-known psychologists, Beaunis, Binet, Ribot, Delabarre, Flournoy, and Weeks, an annual record of psychological progress is projected. The first volume will abstract all books on psychology issued during 1894, and will index all papers published during the same period that deal with the histology, anatomy, and psychology of the nervous system in man and animals, also including its pathology. This new review will also serve as the organ of the psychological laboratory at the Sorbonne.

The first yearly volume of *Taschenbuch für Braunkohlen-Interessenten des nordwestlichen Böhmens* has recently appeared at Teplitz. It consists of 80 pages, with a map.

Dr. C. R. Keyes, whose appointment as Assistant State-Geologist of Iowa we duly chronicled, has proved his worth in the newly-started Annual Report. The first volume contains a description of the geological formations of the State, and a Bibliography; the second is devoted to the coal-bearing rocks. The illustrations in both are exceptionally good, for Dr. Keyes is an artist as well as a geologist. One of them is a photograph, taken in winter, of The Cascade, near Burlington; the frozen waterfall hangs in huge icicles from the projecting ledge of "Augusta Limestone" (a term here applied to the Burlington and Keokuk Limestones combined), while behind are seen the soft underlying Kinderhook beds. We explain this obvious illustration, since it was reproduced by a scientific contemporary as an instance of "a curious formation" of limestone giving "the appearance of a cascade." There are curious things in nature, but this is not one of them: the error has been ingeniously (*not* ingenuously) corrected.

OBITUARY.

ALLEN HARKER, F.L.S.

BORN 1848. DIED DECEMBER 19, 1894.

SCIENTIFIC circles, particularly those of the West of England, have to deplore the loss of a very able man in the prime of life. Allen Harker was in early life engaged in commercial pursuits in Gloucester; but even then he was far more attracted by scientific research, for which education and inclination fitted him. Consequently, in 1881 he was appointed to the Professorial chair of Natural History at the Royal Agricultural College, Cirencester, in succession to Dr. Fream. He had a sound knowledge, both scientific and practical, of the many subjects he was called upon to teach, and was endeared to his students by his sterling genial character, as well as by his ability to impart information. An active member and Vice-President of the Cotteswold Naturalists' Field Club, he communicated a number of papers to its *Proceedings* on the local Natural History. The cuttings on the new line of railway between Swindon and Cheltenham attracted his attention, and he first described the fine section of Kellaways Beds near South Cerney, which was afterwards visited, under his guidance, by the Geologists' Association. Other sections of Cornbrash, Forest Marble, and Great Oolite were described, and in the Great Oolite he discovered traces of *Solenopora*, identified by Professor H. A. Nicholson, and afterwards described by Dr. Alexander Brown. Among other subjects discussed by Professor Harker were the Habits of some Annelids found in Gloucestershire; the Green Colouring Matter of Animals; the Probable early Extinction of a Cotteswold Butterfly; and the Abstraction of Nitrogen from the Atmosphere by Leguminous Plants. He was a member of the Perthshire Society of Natural Science, and Consulting Botanist and Entomologist to the Newcastle Farmers' Club.

WE regret to record the death of the editor of *Knowledge*, Mr. A. COOPER RANYARD, which occurred on December 14. Mr. Ranyard was born in 1845, and was a member of Cambridge University. He was a distinguished mathematician and astronomer, and carried on in an admirable way the late Richard Proctor's labours in the popularisation of his favourite study.

DR. FREDERIK JOHNSTRUP, of Copenhagen, the well-known mineralogist, died on December 31, aged 76 years. He had devoted considerable time to he geology of Greenland and Iceland.

PROFESSOR KARL VON HAUSHOFER, who held the chair of Mineralogy at Munich University, died in that city a few days ago. Professor Haushofer was also the Director of the Technical High School of Munich.

AMONG other losses which it is our misfortune to record are the following:—CAPTAIN ALEXANDER WILLIAM MAXWELL CLARK KENNEDY, of Knockgray, who died on December 23 at the age of 43. He was best known as a traveller and ornithologist, and published a "Birds of Berkshire and Buckinghamshire" under the pseudonym of "Eton Boy" at the age of 16. Dr. FRANCIS BISSET HAWKINS, who died at Bournemouth on Friday, December 7. He was the oldest graduate of Oxford University, having taken his degree at Exeter College in 1818. He was born in 1797, and was one of the men to whom Richard Owen brought a letter of introduction when he came to London from Edinburgh in 1826. AUGUSTE JACCARD, the distinguished Swiss Geologist, who died at Locle, Neuchâtel, early in January. Jaccard began life as a working watchmaker, but his attention was early directed to the rich stores of animal remains in the rocks around his home. Assisted in his researches by friendly hands, Jaccard eventually became Professor of Geology at the University of Neuchâtel. His chief work was undertaken on the Purbeckian beds of the Jura.

PROFESSOR DR. F. A. FLÜCKIGER, who held the chair of Pharmacognosy in Strassburg University and was the author of many works dealing with that subject, died at Bern on December 13. He was born in 1828. Dr. MAX KUHN, Professor at the Königstädt Real-Gymnasium, died the same day at Berlin. His chief work was upon the ferns. Professor Dr. J. SCHRÖTER, of Breslau University, where he held the chair of Bacteriology, died at Breslau on the same day aged 58. The *British Central Africa Gazette* gives particulars of the death of Surgeon Dr. MCKAY, of H.M.S. "Pioneer," who was killed by a lion on October 26 in the S.W. corner of Nyasa. He had a hand-to-hand fight with the beast on the 22nd, and though carefully tended in camp, passed away after much suffering. Dr. McKay was buried at Likoma.

NEWS OF UNIVERSITIES, MUSEUMS, AND SOCIETIES.

Dr. F. Kohlrausch, of Strassburg, has been appointed to succeed the late Professor Helmholtz as Director of the Imperial Physico-Technical Institute at Berlin. Dr. A. C. Oudemans, the director of the Zoological Gardens at the Hague, to be Professor of Natural History to the Gymnasium at Sneek; Dr. d'Arsonval succeeds to the chair of Medicine in the College of France, a position formerly held by the late Dr. Brown-Séquard; Professor Joseph Prestwich has been elected a Vice-President of the Geological Society of France; and Professor F. von Richthofen a corresponding member of the Academy of Sciences, Paris (Mineralogical Section).

The Wayneflete Professor of Physiology, Mr. J. S. Burdon Sanderson, has been appointed to succeed Sir Henry Acland as the Regius Professor of Medicine at Oxford; Dr. S. Nawaschin to be Professor of Botany and Director of the Botanic Gardens at Kiev; F. Oreste Mattirolo, Director of the Royal Botanic Gardens, Bologna, to be Professor; Mr. J. E. Duerden, Associate of the Royal College of Science, London, and for some time Assistant in the Museum of Science and Art, Dublin, to be Curator of the Jamaica Museum, Kingston, Jamaica; Mr. Joseph A. Chubb, B.Sc., to be Assistant in the Liverpool Museum, in succession to the late Mr. R. Paden; and Mr. A. Hutchinson demonstrator of Mineralogy at Cambridge, in succession to Mr. Solly, resigned.

The following appointments have been recently made in America:—Dr. G. M. Dawson to be Director of the Geological Survey of Canada, in succession to Dr. A. R. C. Selwyn, who has been superannuated; A. J. Bigney, to be Professor of Natural Sciences, Moore's Hill College, Indiana; E. G. Conklin, Professor of Biology, North-Western University, Illinois

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As we announced in our November number, the directorship of the Marine Biological Association at Plymouth has been vacated by Mr. E. J. Bles. Mr. E. J. Allen, who has been appointed in his stead, is well-known for his work on the nervous system of the Crustacea. He studied in London under Professor Weldon, and at Berlin under Professor F. E. Schultze.

Professor J. F. Blake, whose appointment by the Gaekwar of Baroda we announced last month, left England on January 9. Mr. W. H. Hudleston goes to India by the same steamer on a pleasure trip. Mr. H. N. Ridley, whose return to England we chronicled in our January number, is, we are glad to learn, resuming his directorship of the Straits Settlements Forest and Gardens Department in June. We hope the financial difficulties of the colony will not be such as to cause the authorities to abolish this important economic post. W. Siehe, of Steglitz, near Berlin, for nine years in the Berlin Botanic Gardens, is starting on a botanical journey to the almost unknown district of Cilicia Trachaea. Professors Haussknecht and Bornmüller have undertaken to work out his collections.

Mr. James William Watts has obtained the Honours diploma for the science and practice of Forestry at the Grand Ducal Forestry College of Eisenach. He comes from Carlisle, and worked for a time at a seed factory in Erfurt. The

University College of North Wales has renewed the research scholarship of Mr. E. T. Jones, who has recently been studying at Berlin. The Berlin Academy of Sciences has awarded Dr. Paul Kuckuck 1,200 marks for the continuance of his investigations on the Algæ of Heligoland.

THE University of Kiev is founding a bacteriological laboratory at a cost of £10,000.

THE awards of the Geological Society have been bestowed as follows:—The Wollaston Medal, Sir A. Geikie; Wollaston Fund, W. W. Watts; Murchison Medal, Professor G. Lindstrom; Murchison Fund, A. C. Seward; Bigsby Medal, C. D. Walcott; Lyell Medal and part of the Fund, Professor J. F. Blake; the remaining part of the Fund is divided between Benjamin Harrison and Percy F. Kendall.

THE Rev. Professor Thomas Wiltshire has resigned the Treasurership of the Geological Society. Professor Wiltshire has served the Society in this capacity for thirteen years, and no one will grudge him his well-earned rest. He succeeded Gwyn Jeffreys in 1882.

MR. WILFRID MARK WEBB, of the Technical Laboratory, Essex County Council, has been added to the editorial staff of *The Journal of Malacology*. The journal, originally called *The Conchologist*, was founded in 1891 by Walter Edward Collinge, of whom a biography and portrait appears in no. 4 of volume iii.

MR. HORACE B. WOODWARD has been appointed "Resident Geologist" to the Geological Survey, in the room of the late Mr. William Topley. Mr. Woodward joined in 1867, and is known to our readers as the author of "The Geology of England and Wales." Mr. Clement Reid, who joined the Survey in 1874, has been promoted to the rank of "Geologist," after twenty years' service. Mr. Reid's chief work has been accomplished on the interesting deposits exposed in the Norfolk Coast, and in a re-survey of the Cretaceous and Tertiary deposits of Southern England, and especially of the Isle of Wight.

A NEW second-class assistantship has been created in the British Museum (Natural History), Cromwell Road. This has been filled by Mr. George Francis Hampson, who has been specially appointed by the Trustees and the Treasury to continue his work on the moths, a work on which he has been engaged at the Museum for some years in an unofficial way. We understand that Mr. Hampson, who is "over age," has not been troubled with the customary ordeal of competitive examination. We believe that this appointment has been made in deference to strong pressure brought to bear by entomologists who have long felt that this department of the Museum is considerably undermanned. It is to be hoped that other members of the scientific public will similarly interest themselves in other departments of the British Museum, which are quite unable to cope with the enormous quantities of material that annually pour into that institution.

THE annual meeting of the Geological Society of London will be held on February 15, at 3 o'clock, when the president, Dr. Henry Woodward, will deliver his annual address, which will deal with the Palæozoic Crustacea; that of the Geologists' Association on Friday evening, February 1, at 7.30 p.m., when General McMahon, the president, will read his address, entitled, "The Geological History of the Himalayas"; that of the Quekett Microscopical Club on February 15, at 8 p.m.

THE Entomological Society of France holds its annual meeting on February 27, and the Italian Botanical Society will hold its annual meeting at Palermo towards the end of April.

THE Museums Association will meet this year at Newcastle-on-Tyne, circumstances having necessitated the abandonment of the proposed visit to Edinburgh.

THE details of the sixth International Geographical Congress were issued by the Royal Geographical Society during the last few days of the old year. The headquarters of the Congress, which will be held in London from July 26 to August 3, 1895, will be 1 Savile Row, W. The subscription is £1, and will entitle the holder of the Congress receipt to attend all meetings and receive all publications concerning the Congress. The subjects specially selected for discussion are: Mathematical Geography; Physical Geography, including Oceanography and Geographical Distribution; Cartography; Exploration; Descriptive, Historical, and Applied Geography, including Anthropo-Geography; and Education. Among the special papers promised are the following: "The Distribution of Density over the Surface of the Earth in Relation to the Force of Gravity," "Geodesy in Relation to the Survey of India," by General J. T. Walker; "Photographic Methods in Surveying," by Colonel H. C. B. Tanner; "On the Construction of Globes," by Professor Elisée Reclus; "Arctic Exploration," by Admiral A. H. Markham; "Antarctic Exploration," by Dr. Neumayer; "History of Early Charts and Sailing Directions," by Baron Nordenskiöld and H. Yule Oldham; and "the Influence of Land Forms and Surface Characters on Occupation, Settlements, and Lines of Communications," by H. J. Mackinder and Professor W. M. Davis. Among the special discussions are "International Coöperation for the Study of the Oceans," for which the following constitute a committee: the Prince of Monaco, Professors Krümmel, O. Petterson, Thoulet, A. Agassiz, and Mr. J. Y. Buchanan; "Limnology and Hydrology as a Branch of Geography," for which the following is the committee: Professors Forel and Penck, Dr. Mill, and Messrs. Delebecque and Marinelli; "a Systematic Terminology of Land Forms," Professors Penck, W. M. Davis, and Dr. von Richthofen, and Messrs. Mackinder and Oldham; "To what extent is Tropical Africa suited for Development by the White Races, or under their Superintendence?" Sir John Kirk, Dr. Dove, and Messrs. Decle and Ravenstein. There will also be reports of the Committee on the Map of the World on the scale of 1:1,000,000, and on an International Bibliography of Geography, while Professors Levasseur and Lehmann and Mr. Freshfield will consider the subject of "Geography in the School and in the University."

An exhibition will also be held, which the Congress desires should be made as fully representative as possible of the present state and past history of geographical science, and it is proposed that this should include: Instruments used in the construction of maps; for observation by travellers; in oceanographical and limnographical research, etc.; maps of all classes, globes, reliefs, models, and appliances in use in geographical education; photographs and pictures of geographical interest; lantern slides of racial types and other anthropo-geographical matters; gear and equipment of all kinds; personal relics; publications of societies and general geographical literature. The Secretaries of the Congress are Messrs. J. Scott Keltie and H. R. Mill, from whom all particulars can be obtained.

THE Isle of Man Natural History and Archæological Society announces that the quarterly magazine of the Society, *Yn Lioar Manninagh*, will shortly be replaced by an annual volume of *Transactions*. The *Transactions* will be more strictly confined to the immediate proceedings of the Society, and will not include the various notes and news printed in the magazine.

THE library of the late Mr. William Topley has been distributed among those to whom the books will be of most service, by desire of his widow and his

son. The Geological Society of London has thus been the recipient of numerous reports and out-of-the-way publications of considerable interest and value.

THE amount contributed by the residuary legatees of the late Sir Charles Watken to clear the debts and liabilities of the Bristol Museum and Library Association to enable the Corporation to acquire the various collections for the citizens was £2,871 2s. 7d. Sir Charles had himself undertaken the responsibility; but dying before he was able to realise his intentions, the residuary legatees generously adopted the responsibility. The Trustees of the British Museum also consenting to the release of their interest in the endowment fund, a deed of May 31, 1894, transferred the premises to the Corporation, and vested the Bristol Museum and Library Association in the same body. The matter was formally reported to the Town Council on December 7, 1894.

THE recent formation of a Field Club Union by the governing bodies of the four Irish field clubs—Belfast, Dublin, Cork, and Limerick—should lead to increased interest in Natural Science in Ireland by bringing workers in different parts of the country into closer connection with each other. The scheme was started at a very successful joint excursion held last summer at Fermoy by the three southern clubs. We learn that during the coming summer all four societies intend to hold a week's conference and excursions, making Galway their headquarters.

THE spring plans for University Extension Lectures at Toynbee Hall for 1895 include the following subjects in Natural Science:—Mr. H. de Haviland will deliver a course of ten lectures on "Darwinism" on Fridays at 8 p.m., and Mr. F. W. Rudler a course on "Our Common Fossils" on Fridays at 8. Botany will be dealt with by Mr. G. May on Thursdays at 7.30; Biology by Miss K. M. Hall on Wednesdays at 7.45; Geology by Miss Raisin on Tuesdays at 7.45; Physiology by Mr. S. Rowland on Mondays at 8 p.m.

WITH regard to the Museum at Para, in Brazil, Dr. E. A. Goeldi, in an official letter, points out the magnificent field which the basin of the Amazon offers for the study and collection of objects of natural history. Dr. Goeldi intends, if he can find support, to found a biological station on the Amazon. We heartily wish him success.

APROPOS of the interesting article on Antarctic exploration by Mr. Southwell in the earlier pages of this number of NATURAL SCIENCE, the following notes on polar matters may be of interest:—An Antarctic expedition to the east of Graham's Land is talked of in Belgium. The route would follow up the recent discoveries of the "Jason," and it is suggested, if the money is forthcoming, that the expedition should leave in September. Should the rigours of the Antarctic prove too much for the party to winter, it is proposed that investigations should be conducted in the lesser known portions of the Indian Ocean. A north polar expedition is projected by Lieutenant Pike, which will leave Tromso in the spring. Lieut. Pike proposes to take with him Sören Krœmer, the well-known hunter and seaman, and proceed to Norse Island *en route* for Franz Josef's Land, where he will build a hut and winter. He hopes to start in the spring of 1896 on sledges for the Pole. There is also projected a Nansen relief expedition, as the "Fram" is thought to have been nipped in the ice.

AN expedition under the auspices of the Russian Geographical Society started early in December for Port Said. Its destination is Abyssinia, and among the party are Professors Jelissejev, Sevjagin, and Leontjev. They are accompanied by an ecclesiastic who carries presents to the Metropolitan of Abyssinia.

CORRESPONDENCE.

The "Zoological Record."

The *Zoological Record* for 1893 is now published, and as usual is sold in one bound volume, so that the students of one group of animals are obliged to buy not only the section they themselves need but also all the others. The price of the whole *Record*, however, is necessarily so high that most people end by buying none at all, which profits neither themselves nor the Zoological Society. To meet this difficulty some of us propose to purchase several copies of the *Zoological Record*, and to distribute the separate parts to subscribers. Although it is not intended to make any profit out of the scheme, it will be necessary to charge rather more for the separate parts than their exact proportional value, since some parts are almost certain to remain unsold. The exact price can only be determined when we know what support we are likely to receive. This scheme applies not only to the volume now issued, but also to previous volumes. Will you permit me, through the medium of your valuable journal, to ask all who may need separate sections from any of these volumes to communicate their exact wishes to me, at the Royal College of Science, London, S.W. ?

This arrangement is, of course, only a provisional one, as it is hoped that the Zoological Society themselves will soon sell the parts separately. Once more it may be pointed out that this will not damage the Zoological Society, for the present purchasers are mainly Libraries, or such other institutions as need the entire volume.

S. Pace.

Merely for Information.

I have seen "the Rosy Feather Star of our seas" gripping in numbers by their cirrhi to stones below tide marks; I have seen them drop off singly into the sea as I lifted the stone into the air, and swim away with medusa-like contractions of their arms; I have also seen them squirming in the silt of the dredge. But I have never seen the "floating colonies" (Natural Science, Dec., 1894, p. 451) of this interesting species. Does your reviewer of Professor Drummond's book mean that "floating colonies" of the Rosy Feather Star are to be found in our seas, or does he wish us to understand that these colonies have an existence only in Drummond's world of pseudo-biology, or in the reviewer's own domain ?

Paddy from Cork.

N.B.—The restoration of Archæopteryx, on p. 443, from Romanes' "Darwin and After Darwin," is a copy of one by Shufeldt which appeared in the *Century* magazine some eight or ten years ago.

"The Study of Existing Glaciers."

Since the appearance of this article in Natural Science, the following names have been sent to me of additional members of the "Commission Internationale des Glaciers." I quote the circular :—

"Denmark	.. ..	M. le Dr. K. I. V. Steenstrup, Copenhagen.
Norway	.. ..	M. le Dr. A. Ojen, de l'Institut Mineralogique, Christiania.
Sweden	.. ..	M. le Dr. Svenonius, Géologue à l'Institut International, Stockholm.

"Les presentations pour les membres de la Commission de l'Italie et de la Russie seront faites au Comité du Congrès par les organes compétants de ces deux pays. La nomination n'est pas encore survenue."

Also, M. le Dr. Léon du Pasquier, Neuchâtel, is a member of the Committee for Switzerland, and is acting as secretary till a formal appointment.

MARSHALL-HALL.

ANLAGEN.

THE meaning of words is determined by long usage and by philological and grammatical considerations, and not by the wishes of a very small section of society whom Mr. Mitchell has called "precise writers," but whom scholars would regard as ignorant blunderers.

For certainly upwards of two thousand years the words "vestige" and "rudiment," in those and slightly different forms, have been in constant use with one fixed and unchanging meaning for each. The two roots of which "rudiment" is compounded are older than European civilisation, and the word itself tells its own meaning. That meaning is *a beginning, a first attempt, or essay; something as yet unfinished, unformed, unpolished; something from which the finished product is to develop.* To apply it to an abortive organ is all very well in poetry, but not in science. Some abortive organs are believed to be lingering traces or remnants of something which has gone. "Vestige" means, and for thousands of years has meant, *a track, or trail, or foot-mark, left behind by something which has gone.* An abortive organ serves as a clue to past structure in some cases, and in these cases the abortive organ is a vestige of previous structure. To apply to either of these two—vestige or abortive organ—the word "rudiment," otherwise than in the sense in which one calls a soldier a "red herring" (that is, in a metaphorical sense), is to go out of one's way in search of confusion.

C. HERBERT HURST.

A CORRECTION.

OUR reviewer of the second edition of Blanford and Medlicott's "Manual of the Geology of India," writes to say that he finds he has misrepresented the difference between the two editions (1879 and 1893) in reference to the age of the Western Ghats. He stated that, in the earlier, the formation of the western scarps by marine denudation was "maintained," whereas it was advanced as a hypothesis only. "The statement also, that Mr. Oldham's evidence was conclusive as to the truth of the alternative theory, is too emphatic; Mr. Oldham admits (p. 495), that until the ground at the western foot of the Ghat-scarp has been examined more in detail, the theory cannot be finally established."
